WEST VIRGINIA GEOLOGICAL SURVEY

PLATE I.—Marlinton. A beautiful panoramic view of Marlinton and vicinity looking north. The tow
Knapp Creek. The two streams join just outside the picture. The Harrisburg Peneplain is
seen towering in the extreme left. (Photo by Gay's Studio, Marlinton).

town is located upon a joint flood-plain of Greenbrier River (on the left) and
n is seen at its best in this view. Red Lick Mountain, at the head of Elk, is

WEST VIRGINIA

GEOLOGICAL SURVEY

Pocahontas County

By

PAUL H. PRICE, Assistant Geologist

DAVID B. REGER, Assistant Geologist in Charge.

1929

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LETTER OF TRANSMITTAL.

To His Excellency, Hon. William G. Conley, Governor of West Virginia, and President of the West Virginia Geological Survey Commission:

SIR:

I have the honor to transmit herewith for publication the Detailed County Geologic Report and accompanying topographic and geologic maps covering Pocahontas County. The county contains 942 square miles of territory and is therefore third largest in point of size in the State. In the potential value of its minerals it is also important, having three different geographic zones of outcropping rocks which should merit careful attention. In the northwestern part there is a wide zone of Carboniferous, or Pennsylvanian, rocks containing a large reserve of New River semi-smokeless coal none of which has yet been commercially mined but much of which will eventually come into the market. In the central part, just northwest of the Greenbrier River, there is a great belt of Mississippian rocks the principal features of which are the limestones of the Greenbrier Series with superimposed red shales and more shaly limestones of the Mauch Chunk Series. Taken together with the red Maccrady shales which lie below the Greenbrier, these beds, when weathered, afford the material for certain soil types used most successfully both for grazing and for cultivation of crops. The limestones of the Greenbrier, also, afford an inexhaustible supply of good road material and concrete aggregate and are suited for the manufacture of Portland cement which would be a most valuable industry if introduced into this county. There is also a possibility that certain crystallized portions will make good building stone. In the eastern part of the county the generally siliceous beds of the Devonian and Silurian are not so well suited for agriculture but they contain a large reserve of iron ore which will be of eventual value when fully prospected, and they also exhibit some heavy quartzitic ledges which may be of service for building stone or for ganister rock.

The geology of the county has been carefully studied and described by Mr. Paul H. Price, Assistant Geologist, the work having been begun in 1926 during the administration of the late Dr. I. C. White, State Geologist, whose death, on November 25, 1927, occurred before all the field work had been completed and before the manuscript had been prepared. Subsequently, during my administration, the field work has been finished and the manuscript has been prepared with my supervisory and editorial approval.

The work of Mr. Price has been ably seconded by that of Dr. John L. Tilton, Paleontologist, who examined and described the marine fossils; by Mr. B. B. Kaplan, Chemist, who analyzed all chemical samples; and by Mr. R. C. Tucker, Assistant Geologist, who had general charge of proof-reading and printing and who prepared the index and certain statistical and introductory matter. During the course of the field work, also, Dr. David White, Principal Geologist, U. S. Geological Survey, made several collections of plant fossils in the Devonian and Mississippian, assisted by Mr. Price and myself. A description and discussion of these fossils by Dr. White will appear in a later publication.

Within a few years a study of the agricultural soils of the county will be made by an expert of the Bureau of Chemistry and Soils of the U. S. Department of Agriculture with the consequent publication of his findings in a bulletin and map, as has been done in other counties.

Veiy respectfully,

DAVID B. REGER,
Assistant Geologist in Charge.

Morgantown, W. Va., June 17, 1929.

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PART III. MINERAL RESOURCES.

PART IV. PALEONTOLOGY.

ILLUSTRATIONS

Maps I and II in Atlas (Under Separate Cover).

Plates.

Figures.

AUTHOR'S PREFACE

This book is a general geological report on Pocahontas County, West Virginia. As shown by the Table of Contents, it contains a short chapter on Historical and Industrial Development, a chapter on Physiography, nine chapters on Geologic History, Structure, and Stratigraphy, three chapters on Mineral Resources, and one chapter on Paleontology, as well as an Appendix giving all available spirit-level bench marks and railroad levels and a gazetteer giving the location of all points in the county.

In a separate Atlas Maps I and II respectively show the topography and geology of the county. On these maps the topographic base is assembled and photolithographed from the standard topographic quadrangles as surveyed and published by the United States Geological Survey in cooperation with the West Virginia Geological Survey, with certain cultural corrections added by the author. On this corrected base the geologic map was drawn.

Pocahontas County, lying between the folded Appalachians and the plateau region, offers a most interesting area for geologic study. The outcropping rocks, including those from the lower Silurian to the Kanawha Group of the Pennsylvanian, embrace a total of about 13,500 feet of strata, and contain large quantities of Coal, Limestone, Building Stone, Clays, and Iron Ore. In addition the area contains numerous Mineral Springs located in the midst of beautiful scenery and wonderful climate.

The author spent a part of the field season of 1926 and the summer months of 1927 in gathering data for this report, and also about one month of the season of 1928. In its preparation valuable aid was given by other members of the Survey Staff. The chapter on Paleontology was prepared by Dr. John L. Tilton, Paleontologist for the Survey. The chemical and calorific tests, except as otherwise specified in the text, were made by Dr. B. B. Kaplan, Survey Chemist.

To Mr. R. C. Tucker, Assistant Geologist, credit is given for the preparation of the introductory matter, the index, and the gazetteer, which should be of great aid in locating any

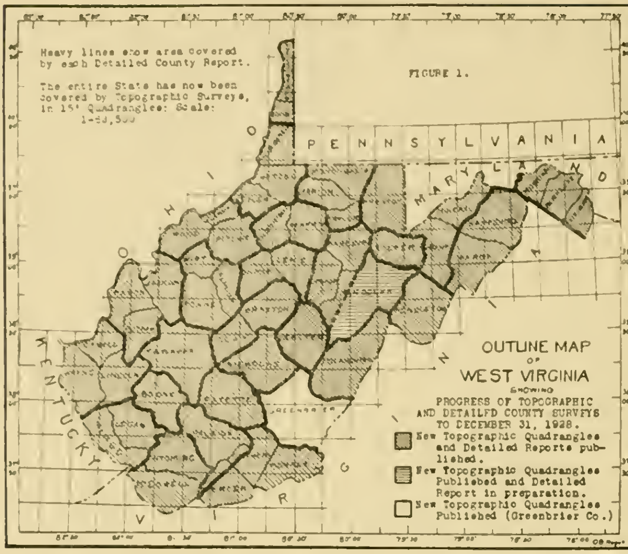

Figure 1.—Outline Map of West Virginia showing Progress of Topographic and Detailed County Surveys to December 31, 1928.

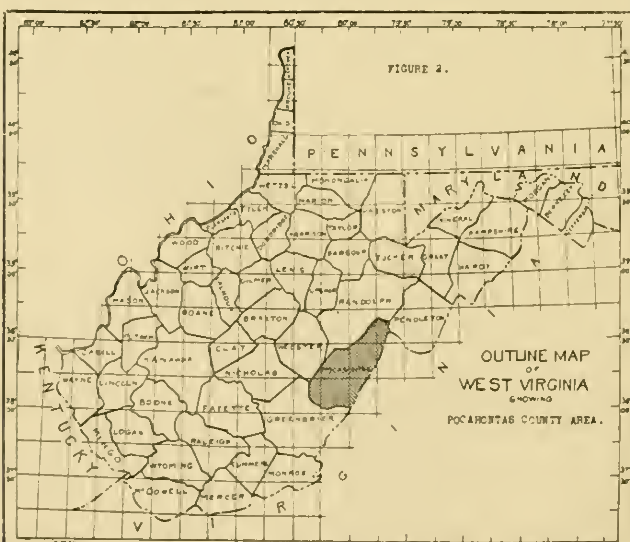

Figure 2.—Outline Map of West Virginia showing Pocahontas County area.

particular name or place on the map, also for proof-reading the volume, as well as for criticisms and valuable suggestions.

It is impossible to make detailed mention of the many citizens of the county who most generously assisted the writer while field work was in progress, but to all these general acknowledgment is here made. By way of exception, however, special acknowledgment is due to Messrs. Andrew Price and Calvin Price, of Marlinton, whose special interest in geology and whose wide acquaintance throughout the county, and whose many acts of courtesy to the author are remembered with sincere pleasure.

The writer is greatly indebted to the late Dr. I. C. White under whose direction the present report was inaugurated. It was in company with the writer on a visit to Pocahontas County during the summer of 1927 that he made his last geologic field trip.

Finally, the writer expresses his appreciation to Mr. David B. Reger, Assistant Geologist in Charge, for his supervision, kindly criticism and instructive suggestions, which have added greatly to the value of the report.

PAUL H. PRICE.

Morgantown, W. Va., December 18, 1928.

ERRATA.

Page 69, line 18 from top, for "No...., pp....;" read "No. 1, Series 29, pp. 107-117;".

Page 89, bottom line, Omit "strains and".

Page 131, under Gilbert "A" Coal, line 12, add "(Prospect No. 13 on Map II)".

Page 183, bottom line, for "pp....-...;", read "pp. 107-117";.

Page 224, bottom line, for "Linguella", read "Lingulella".

PART I.

History and Physiography.

CHAPTER I.

HISTORICAL AND INDUSTRIAL DEVELOPMENT.

LOCATION.

The area treated in this Report is Pocahontas County with sufficient information on adjoining areas to show the relation thereto. Pocahontas is situated along the eastern border of the State just south of center, being included between the parallels 38° 00′ and 38° 45′ north latitude and 79° 35′ and 80° 25′ west longitude from Greenwich. It is bounded on the north by Randolph County, on the east by Pendleton County and Highland and Bath Counties, Virginia, on the south by Greenbrier County, and on the west by Greenbrier and Webster Counties. The eastern boundary follows the summit of Allegheny Mountain, while the remaining boundaries are arbitrary. The greater part of the county is drained by Greenbrier River which has its source in the extreme northeastern corner and flows in a general southwest direction, thus roughly bisecting the county. The western part of the county is drained by Cherry, Cranberry, and Williams Rivers, tributaries of Gauley River, Elk River, and Shavers Fork of Cheat River. Pocahontas County is very irregular in outline, having no definite form. Its greatest length northeast-southwest is approximately 56 miles, and its greatest width southeast-northwest is 29 miles. Its geographical position is shown on Figure 2 in the Author's Preface.

TRANSPORTATION.

WATERWAYS.

Transportation by means of waterways has played a minor part in the economic development of the county. In the early days, however, several of the larger streams were used in floating logs to the mill. Particularly was this true in the western part of the county where temporary dams were built. These were released during the rainy season carrying the logs to the mill, then located at Richwood. This method, although expedient in those days, proved very wasteful. Evidence remains to this day of many fine logs that never reached their destination. In more recent years this method has been replaced by steam railroads. (See Chapter on Water-Power).

STEAM RAILROADS.

Chesapeake and Ohio Railway.—Greenbrier Division.— The Greenbrier Division of the Chesapeake and Ohio Railway is a branch from the main line at Whitcomb, Greenbrier County, and extends northward across this county into Pocahontas, following the Greenbrier River to its northern termination at Winterburn Station (Thornwood P. O.). At Durbin it connects with the Western Maryland Railway. It was completed to Cass in 1901, to Durbin in 1902, and to Winterburn in 1905. The completion of this railroad marked a new era in the prosperity of Pocahontas County and has continued to be one of the most valued assets of this county.

In reply to an inquiry regarding its construction, first operation, and track mileage, the late G. B. Wall, Vice-President, supplied the following summary:

"The construction of this branch began in June, 1899, and was completed in June, 1905. The date of the first operation of trains over the Greenbrier Branch in Pocahontas County was in December, 1900. The mileage of this branch in Pocahontas County, West Virginia, is—Main Line, 65.5 miles, with 12.73 miles of sidings."

Western Maryland Railway. — Durbin Branch. — The Durbin Branch of the Western Maryland Railway extends from Elkins, Randolph County, to Durbin, and there connects with the Greenbrier Division of the Chesapeake and Ohio Railway. According to J. W. Broome, Superintendent, this branch was completed by the Coal and Iron Railway Company on August 1, 1903, and was purchased by the present owners on November 1, 1905. In Pocahontas County there are 17.62 miles of main track with 2.01 miles of sidings.

Spruce Branch.—During 1928 the Western Maryland Railway Company purchased that portion of the Greenbrier, Cheat and Elk Railroad beginning at Cheat Junction, Randolph County, and extending south along Shavers Fork to Spruce, where it turns west, crossing through the mountain passes between the headwaters of Tygart, Cheat, and Elk Rivers, and then down Big Spring Fork of Elk to Slaty Fork. From this point it extends northwestward down main Elk, passing into Randolph County at the mouth of Douglas Fork, and entering Webster County at the Whitaker Falls, and thence proceeding down the south side of the river to Bergoo at the mouth of Leatherwood Creek. This road is entirely of standard gauge, the principal function of which in previous years was as a log carrier for the West Virginia Pulp and Paper Company. This road will provide a general freight and passenger service in this territory, which also includes extensive coal deposits of eastern Webster, southern Randolph, and northwestern Pocahontas Counties.

West Virginia Pulp and Paper Company Lumber Railroad.—Certain portions of what was formerly the Greenbrier, Cheat and Elk Railroad were not included in the Western Maryland purchase and are now operated by the West Virginia Pulp and Paper Company. These include a branch from Slaty Fork extending around the eastern side of Gauley Mountain and entering Randolph County near the northern prong of Big Run, and another branch from Spruce southeastward across Back Allegheny Mountain, through a mountain pass 3,940 feet above sea-level, down Leatherbark Run, to Cass where it connects with the Chesapeake and Ohio Railway. According to Charles W. Luke, Manager of the Company operations at Cass, the branch extending from Slaty Fork into Randolph County on Gauley Mountain will be taken up after the timber is removed from that area, but the branch connecting the Chesapeake and Ohio at Cass with the Western Maryland at Spruce will in the future be operated by the Lumber Company as a private railroad.

HIGHWAYS.

State Roads.

In many of our counties ingress and egress by motor during the winter months have been possible only during the last few years, Pocahontas County being no exception. Since the revision of the road laws in 1921 and the establishment of a State Road Commission, this condition is fast being remedied. When the present road-building program is completed all West Virginia county-seats will be connected with hard-surfaced roads, as well as to the main arteries of travel outside the State.

From the State Road Commission's Official Map, the topographic maps of the United States Geological Survey, and the writer's own knowledge of the roads in Pocahontas County, the following information is given:

State Route No. 24.—(Seneca Trail, in part).—State Route No. 24 begins at Princeton, Mercer County, and continues east across Mercer to Glenlyn, Virginia, thence following the meanders of New River by way of Lurich to Narrows, crossing New River, and thence north along this stream to Rich Creek and thence to Peterstown, West Virginia. Continuing in a northeast direction across Monroe and Greenbrier Counties, it crosses the Midland Trail (Route No. 3) at Lewisburg, and entering Pocahontas County on Droop Mountain southwest of Hillsboro, continues through Marlinton, passing just west of Edray to Slaty Fork. Here the road turns east to Linwood where it again turns north, leaving Pocahontas and entering Randolph, at Mace, and continues north in Randolph County to Huttonsville where it joins the Staunton and Parkersburg Pike which is there coincident with Route No. 56.

In Pocahontas County, this road, which is 67.68 miles long, has all been graded, and from the Greenbrier-Pocahontas County line to Campbelltown through Hillsboro, Mill Point, Buckeye, and Marlinton, is a good paved road. From Campbelltown the road has been relocated so as to ascend the steep grade just west of Campbelltown, joining the old road about one mile farther north. Again just south of Edray the road takes a new course, securing a much better grade by ascending Wolfpen Ridge and joining the old road at the summit. From the summit the new road follows, in general, the old except to straighten out abrupt curves and secure better grades. From Campbelltown to the county line at Mace, by way of Slaty Fork and Linwood, the road has been graded. This route is one of the most scenic in the State.

State Route No. 56 or Staunton and Parkersburg Pike.—State Route No. 56 enters Pocahontas County from Staunton. Virginia, by way of Monterey, 2½ miles east of Top of Allegheny, descending this slope to Bartow on the East Fork of Greenbrier River, thence following the north side of this stream to Durbin, here crossing the West Fork of Greenbrier River and ascending Back Allegheny Mountain by the best possible grade and leaving Pocahontas and entering Randolph on the saddle between Back Allegheny and Shavers Mountains. It then continues in a northerly direction to Elkins, thence across Barbour County by way of Philippi, and thence almost due north to Grafton in Taylor County where it joins the Northwestern Pike. From the Virginia line to Bartow, 10 miles, it is unimproved but is a good dirt road. From Bartow to Greenbrier River at Durbin, 3.58 miles, it is a good paved road. From Durbin to the Randolph County line, 5.6 miles, the final grading is completed. This route is also one of the State's scenic highways.

State Route No. 42.—State Route No. 42 is entirely within the limits of this county, starting from Route No. 56 at Bartow and passing south by way of Boyer, Green Bank, Dunmore, and Frost, and connecting with Route No. 43 just west of Minnehaha Springs. This route, which is 32.84 miles long, has been graded and improved with local chert gravel during the last few years and is now being given a macadam binder that assures an excellent road throughout the year.

State Route No. 43.—This route is also a short one.

having its limits within the county, from Marlinton to the Virginia State line by way of the Knapp Creek gorge and Minnehaha Springs. From Marlinton to the Minnehaha Springs bridge, it is a good paved road, but thence to the Virginia line is unimproved.

County Roads.

The greater part of Pocahontas County is connected with good county roads leading to the main arteries of travel that have been built and are now maintained by the State Road Commission. The county roads, constructed and maintained under the supervision of the County Commissioners, compare favorably with other counties of the State. Taking advantage of the abundance of chert, gravel, and limestone, many miles of county roads are passable throughout the year. In the western part of the county, however, very few roads of any description are found, travel being confined to the rough mule trails that follow the valleys or mountain ridges, and to the logging railroads.

DROOP MOUNTAIN BATTLEFIELD STATE PARK.

Droop Mountain Battlefield State Park is located on the northern end of Droop Mountain just west of and adjoining the Seneca Trail (State Route No. 24) at Spice P. O. Here the State has bought 125 acres, or a part of the battlefield, for a State Park, as a memorial to the soldiers who fought (November 6, 1863) in the greatest battle of the Civil War on West Virginia soil.

Droop Mountain and vicinity is one of the beauty spots of the State, with magnificent views on all sides. On the east and a thousand feet below, an occasional glimpse of the Greenbrier River can be seen, while on the northeast is the town of Hillsboro located in a broad limestone valley surrounded with many fine well-kept farms. On the west stand the rugged mountains that compose the Yew Range and separate the Greenbrier drainage from that of the Gauley. The park was dedicated July 4, 1928.

From the standpoint of both historic interest and scenic beauty, this park should be one of the most popular in the State.

GENERAL DESCRIPTION.

MISCELLANEOUS ITEMS.

Formation.—Pocahontas County was formed by an Act of the General Assembly of Virginia in December, 1821, from parts of Bath, Pendleton, and Randolph Counties.

In a letter from Andrew Price of Marlinton, West Virginia, on December 15, 1927, he quotes from "Dyer's Index" regarding the formation, as follows:

"Beginning at the line of Greenbrier County on top of the Alleghaney Mountain, thence with the said line to the head of Spice Run, thence with said line to the end of the Droop Mountain, thence with said line to Fryer's Knob, thence with said line to where it intersects the line of Bath and Randolph, thence with the line dividing Randolph and Greenbrier Counties to the mountain opposite the junction of the Bannock Shoals Run with Williams River, thence a straight line to the mouth of the Dry Fork of Elk River, thence a straight line to the top of the mountain between the head of the Valley River and the point last aforesaid, where the road leading from Clover Lick to Randolph courthouse crosses said mountain, thence a straight line to where the line of Pendleton County intersects the line of Bath and Randolph Counties on top of the mountain between Cheat and Greenbrier Rivers, thence with the top of said mountain to where the road* leading from Slaven's to Randolph courthouse crosses it, thence a straight line to the top of the Alleghaney Mountain opposite the head of the east fork of the Greenbrier River, thence with the top of said mountain to the Pendleton line, thence with the top of said mountain to the beginning."

*Here Mr. Price comments further as follows:

"From this point the original calls show an ignorance on the part of the draftsman of the bill as to the topography of the country and the calls are ambiguous. If complied with it was found that it would cut the county of Pendleton in two parts not joining. In the controversy with Randolph County in the eighties the commissioners fixed the present boundaries of the county to continue north of the Slaven road with the top of the mountain to a point opposite the divide between the headwaters of the Glady Fork of Cheat River and Greenbrier River, thence with the meandering of the crest of that divide to the top of Alleghany Mountain, and thence with the top of that mountain to the beginning."

"The present boundary of the county from the point where the road from Clover Lick crosses now the point where the Seneca Trail or Road 24 crosses Valley Mountain, to the Alleghany Mountain by way of Cheat River, is the original boundary of the District of West Augusta in part."

As pointed out by Mr. Price the original boundaries were ambiguous and many of the older maps, including the State map of the Survey, show the line from the Staunton and Parkersburg Pike on Cheat Mountain as a straight line to the Crest of Allegheny. The last commission appointed to fix the boundary between Pocahontas and Randolph made it so as to include the watershed of Greenbrier River in Pocahontas County. This would seem to be the logical boundary.

Area.—The present area of Pocahontas County, as determined with planimeter from the topographic sheets of the United States Geological Survey, is as follows:

Districts.	Square Miles.
Greenbank	319.24
Huntersville	193.64
Edray	237.05
Little Levels	192.68
Total	942.61

Relief.—The surface of Pocahontas County is for the most part rugged and mountainous, the causes of which will be discussed in detail under the Chapter on Physiography. The eastern side of the county has been greatly dissected by the Greenbrier River and its tributaries, the river having left steep precipitous banks below the level of the Harrisburg Peneplain. The western side of the county, marking the true beginning of the Appalachian Plateau, has its drainage to the west, the various rivers having cut deep channels below the level of this ancient plateau. The entire county stands high above sea-level, a large part of it reaching well above the 4000-foot level.

The surface varies in elevation from 1,952 feet on Greenbrier River at the Pocahontas-Greenbrier County line to 4,842 feet at Bald Knob on Back Allegheny Mountain, 3½ miles northwest of Cass, making a total difference of 2,890 feet, the latter point being only 18 feet lower than Spruce Knob in Pendleton County, the highest point in the State, with an elevation of 4,860 feet.

Climate.—From the standpoint of climate Pocahontas might be divided roughly into two parts, that is, highlands and valleys or lowlands. Being a very mountainous county with high elevations and located on the western side of the main Alleghenies, it is subject to severe winters. The valleys, however, being protected on either side, have less severe winters. During the summer months the weather is ideal, seldom averaging over 70 degrees Fahrenheit during July, the warmest month of the year. The nights are cool and ideal for sleeping. Pocahontas County's climate should be considered as one of its large assets.

Climatological facts can best be gained by examining the records of past years. This county is particularly fortunate in having such a public-spirited citizen as Mr. S. L. Brown, Clerk of the County Court, who has kept practically a complete record of temperature, rainfall, and snowfall at Marlinton since 1893. At Arbovale complete rainfall records have been kept since December, 1924, by Mr. H. S. Sutton.

The following statistics concerning temperature, precipitation, snowfall, and frosts at Marlinton, and the precipitation data at Arbovale, as secured by the above observers, were furnished by H. C. Howe, Section Director, United States Weather Bureau, Parkersburg, West Virginia:

Monthly, Annual, and Mean Temperature in Degrees Fahrenheit at Marlinton. S. L. Brown, Observer.

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
1893	....	32.2	39.4	50.6	56.6	67.2	....	....	....	51.6	38.0	32.4	......
1894	33.1	31.3	41.1	47.2	....	66.9	....	....	....	....	38.9	....	......
1895	....	28.5	37.5	....	....	....	....	....	....	43.4	42.5	32.4	......
1896	29.1	31.1	34.8	53.0	66.1	69.7	71.0	68.7	61.4	47.4	44.4	31.4	50.7
1897	25.1	33.2	41.7	47.6	55.1	65.2	69.6	67.1	60.9	53.8	39.7	33.9	49.4
1898	33.8	30.0	45.6	43.9	60.0	66.9	71.2	69.8	64.3	52.2	....	....	
1899	29.6	26.4	39.8	48.8	61.0	69.0	70.2	70.0	60.4	53.4	41.4	28.8	49.9
1900	30.5	28.1	36.0	48.2	59.5	68.6	69.8	72.0	67.2	55.8	38.8	30.6	50.4
1901	30.0	25.6	38.6	43.1	58.3	66.8	73.4	68.3	60.0	50.0	33.0	29.8	......
1902	....	....	....	....	....	....	....	....	....	....	....	....	......
1903	....	....	....	47.2	58.9	62.1	69.0	68.6	61.9	49.5	33.4	22.4	......
1904	23.0	25.0	....	44.0	57.4	64.8	66.0	66.2	62.0	48.8	34.0	30.0	......
1905	....	....	41.3	48.8	60.5	66.2	69.7	67.6	61.0	50.0	40.0	....	......
1906	....	....	....	....	....	....	....	....	....	....	....	....	......
1907	....	....	....	42.2	57.6	....	70.0	67.5	64.0	....	....	32.6	......
1908	23.6	26.6	43.8	51.1	62.4	....	....	....	....	....	....	....	......
1909	....	....	....	....	....	....	64.8	65.2	58.6	44.6	43.2	24.9	......
1910	28.7	28.7	44.0	48.6	....	60.9	67.6	64.8	64.1	50.7	32.0	23.6	......
1911	32.8	34.0	35.4	44.0	61.2	67.2	70.2	72.8	69.1	57.6	39.1	37.2	51.7
1912	23.2	27.8	40.4	52.4	58.9	62.4	69.4	66.0	65.8	52.4	36.2	28.8	48.6
1913	34.4	29.9	40.4	47.5	56.2	64.6	69.2	67.0	58.0	47.4	38.6	31.2	48.7
1914	31.7	27.6	35.0	48.6	53.9	65.8	65.8	65.6	....	....	....	....	......
1915	26.3	32.6	29.0	48.4	55.4	61.0	65.0	64.0	61.5	51.3	37.5	26.6	46.6
1916	32.4	28.8	33.4	44.3	58.1	60.5	68.2	67.2	57.2	48.0	37.2	27.7	46.9
1917	29.4	27.1	36.9	45.8	50.2	61.2	66.3	64.2	57.4	42.7	33.[illegible]	18.0	44.4

Monthly, Annual, and Mean Temperature in Degrees Fahrenheit at Marlinton, (Continued). S. L. Brown, Observer.

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sspt.	Oct.	Nov.	Dec.	Annual.
1918	16.0	28.8	40.3	44.3	60.8	61.8	64.0	68.6	54.3	50.0	35.9	33.8	46.6
1919	26.1	29.1	39.0	46.0	56.2	66.0	67.5	63.6	59.0	56.2	37.4	26.0	47.7
1920	25.3	26.4	34.8	43.6	52.6	60.4	62.3	64.0	....	....	....	29.1	......
1921	28.4	31.2	45.3	46.6	53.9	65.0	69.2	61.8	63.4	44.7	38.3	29.8	48.1
1922	23.6	31.8	38.2	46.4	56.0	63.4	65.5	60.9	61.0	48.4	36.8	31.8	47.0
1923	28.6	27.7	36.0	44.4	54.5	65.0	64.8	65.3	60.5	46.2	36.1	36.6	47.1
1924	24.6	27.3	34.0	45.0	51.7	63.6	64.2	65.9	55.6	49.2	37.2	28.0	45.5
1925	25.0	35.2	38.0	49.3	52.4	66.4	66.0	64.2	64.9	44.6	35.0	27.4	47.4
1926	24.3	30.2	29.9	41.6	56.4	60.3	66.0	67.4	63.0	49.1	34.0	29.0	45.9
1927	28.6	37.0	41.2	46.8	56.4	61.4	65.9	61.9	60.6	50.7	40.5	28.2	48.3
Means	27.7	29.6	38.3	46.8	57.0	64.5	67.6	66.4	61.4	49.8	37.6	29.4	48.0

Monthly, Annual, and Mean Precipitation in Inches at Marlinton. S. L. Brown, Observer.

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
1893	....	5.49	1.72	2.91	4.47	5.80	....	....	....	5.32	1.99	1.91	......
1894	1.81	3.39	1.84	2.06	....	2.69	....	....	....	....	1.84	....	......
1895	....	1.05	1.46	4.41	2.40	....	....	....	....	1.35	1.82	4.14	......
1896	1.45	5.26	6.99	1.82	3.74	3.71	7.80	3.28	4.88	1.22	4.93	1.08	45.76
1897	2.17	5.88	5.21	2.85	7.06	5.59	5.65	2.74	0.80	0.95	4.08	4.64	47.62
1898	5.61	1.47	5.23	4.32	5.27	7.50	6.76	9.15	3.33	4.54	3.85	3.71	60.74
1899	3.26	5.32	6.28	1.60	7.68	1.92	2.95	3.43	4.01	1.56	0.83	3.09	41.93
1900	1.99	5.22	4.92	2.25	2.80	5.32	5.69	2.42	2.57	1.90	7.11	2.99	45.18
1901	3.58	0.97	3.06	6.13	5.11	8.77	3.59	8.03	....	....	....	....	......
1902	....	....	....	....	....	....	....	....	3.69	....	....	....	......
1903	....	....	....	4.04	1.79	4.55	2.98	3.30	1.83	1.52	0.93	2.44	......
1904	4.11	3.10	....	1.12	3.43	2.98	....	....	....	....	....	....	......
1905	....	....	3.27	2.05	3.91	7.57	8.25	2.60	....	....	....	....	......
1906	....	....	....	....	....	....	....	....	....	....	....	....	......
1907	....	....	....	....	....	....	....	....	....	....	....	....	......
1908	....	3.22	....	....	....	....	....	....	....	....	....	....	......
1909	....	....	....	....	....	....	....	....	1.59	3.31	1.90	3.34	......
1910	4.32	2.75	0.59	2.50	2.67	7.38	7.09	5.58	3.56	2.03	1.14	3.63	43.24
1911	7.21	2.23	4.77	4.48	1.35	1.97	2.07	6.54	3.61	5.96	3.66	3.55	47.40
1912	2.46	2.80	6.12	3.17	4.52	3.45	2.67	1.88	4.56	1.53	2.18	4.20	39.54
1913	4.42	2.70	5.80	3.75	5.20	2.85	4.70	3.74	2.02	5.43	3.05	2.75	46.41
1914	2.51	3.19	2.54	4.58	1.54	2.37	3.73	5.22	1.75	3.70	1.10	5.30	37.53
1915	7.42	4.16	1.33	1.86	3.34	4.46	3.90	4.20	4.10	4.47	2.82	4.18	46.24
1916	4.09	3.51	4.88	3.10	3.72	5.32	7.14	4.78	4.31	1.90	1.75	3.38	47.88
1917	4.63	3.62	9.40	2.70	4.09	2.23	7.22	2.07	3.37	3.29	0.94	2.11	45.67
1918	6.44	2.98	6.52	6.50	4.38	10.11	4.62	5.60	4.73	4.64	1.92	5.18	63.62
1919	5.84	3.41	4.69	3.11	6.71	7.01	9.20	4.58	1.36	4.43	4.99	5.21	60.51
1920	4.03	2.78	5.04	5.56	3.05	5.53	5.24	8.90	3.40	0.80	4.75	4.37	53.45
1921	3.48	1.59	3.49	1.63	3.15	4.14	3.09	3.36	3.45	4.26	4.44	4.62	40.70
1922	3.28	5.49	6.13	3.33	5.19	4.66	5.34	6.57	0.95	1.67	1.01	6.26	49.88
1923	4.64	4.11	4.38	4.31	2.78	3.44	5.30	4.89	2.92	1.53	4.01	4.82	47.13
1924	5.26	3.41	3.65	3.53	6.49	4.54	5.06	5.85	7.68	0.10	3.11	3.75	52.43
1925	4.53	1.64	3.94	2.85	2.05	4.38	6.40	2.48	2.27	6.93	4.16	1.93	43.50
1926	4.93	3.94	4.27	3.08	4.57	3.10	7.03	10.56	3.00	5.44	3.60	7.40	60.92
1927	2.74	6.68	2.83	7.84	2.60	4.05	4.56	5.55	1.29	4.28	4.03	4.78	51.23
Means	4.08	3.50	4.30	3.45	3.97	4.74	5.31	4.90	3.10	3.11	2.93	3.88	47.27
Average Number Rainy Days ..	11	10	10	11	11	11	14	12	6	7	7	10	120

Monthly, Annual, and Mean Snowfall in Inches at Marlinton. S. L. Brown, Observer.

Year.	Jan.	Feb.	Mar.	Apr.	May	Oct.	Nov.	Dec.	Annual.
1893...	M	18.5	1.0	......	......	......	2.5	3.0	....
1894...	6.0	18.0	1.0	T	......	......	5.0	M	....
1895...	M	8.0	10.5	1.0	......	......	0.5	9.8	....
1896...	1.1	3.1	14.2	1.5	......	......	3.0	2.0	24.9
1897...	10.0	13.5	6.0	T	......	......	1.0	4.0	34.5
1898...	9.0	3.0	6.0	2.5	......	......	3.5	11.7	35.7
1899...	4.0	27.5	3.0	T	......	......	T	8.0	42.5
1900...	T	7.0	21.0	T	......	......	1.5	2.5	32.0
1901...	9.3	1.5	0.5	......	......	......	M	M	....
1902...	M	M	M	M	......	1.0	1.5	11.0	....
1903...	M	M	M	T	T	......	3.0	12.0	....
1904...	10.5	10.5	M	T	T	......	M	M	....
1905...	M	M	T	1.0	......	......	M	M	....
1906...	M	3.5	26.5	......	......	......	M	M	....
1907...	M	M	M	M	......	......	M	M	....
1908...	M	32.0	M	M	......	T	7.0	20.1	....
1909...	M	M	M	M	......	......	M	M	....
1910...	5.0	9.0	4.0	......	......	T	T	15.0	33.0
1911...	9.0	3.5	6.5	......	......	......	0.2	1.5	20.7
1912...	11.5	6.0	5.5	......	......	......	T	8.0	31.0
1913...	4.0	1.0	T	1.0	......	......	3.0	2.5	11.5
1914...	14.6	20.0	15.5	......	......	......	M	M	....
1915...	19.0	T	6.0	0.5	......	T	2.0	7.0	34.5
1916...	10.5	6.5	7.0	10.0	......	......	T	14.5	48.5
1917...	8.5	6.0	2.5	T	......	3.0	T	18.0	38.0
1918...	31.0	5.0	T	8.5	......	......	T	1.5	46.0
1919...	8.5	7.5	T	T	......	......	0.5	6.5	23.0
1920...	1.0	5.0	0.5	2.0	......	......	M	2.5	M
1921...	9.0	10.0	T	T	......	T	T	5.5	24.5
1922...	15.0	16.0	1.5	T	......	......	0.5	1.0	34.0
1923...	9.5	9.0	2.0	0	1.5	......	T	1.0	23.0
1924...	2.0	9.0	3.5	2.0	......	......	5.0	T	21.5
1925...	23.5	T	6.0	T	......	13.0	T	T	42.5
1926...	11.5	9.5	16.5	6.0	......	T	T	1.5	45.0
1927...	4.5	7.0	1.0	0.5	......	......	2.0	1.0	16.0
Means.	9.5	9.2	5.8	1.2	T	0.6	1.6	6.3	31.5

M indicates report missing.

T indicates trace.

No snowfall recorded in June, July, August, or September, 1893-1927.

Frost Data at Marlinton. S. L. Brown, Observer.

Year.	Date of last killing frost in spring.	Date of first killing frost in autumn.	Length of growing season—last killing frost to first killing frost.	Latest date with temperature 32 degrees or lower in spring	Earliest date with temperature 32 degrees or lower in autumn.
1893	May 19	Oct. 16	149	May 19	Oct. 16
*	*	*	*	*	*
1896	Apr. 23	Sept. 24	153	Apr. 23	Sept. 24
1897	May 4	Sept. 21	139	May 4	Sept 21
1898	May 13	Oct. 15	154	May 9	Oct. 15
1899	Apr. 17	Sept. 28	163	Apr. 17	Sept. 28
1900	May 10	Oct. 11	153	May 10	Oct. 11
1901	May 14	*	*	May 14	*
1902	*	Sept. 10	*	*	Sept. 10
1903	May 6	Sept. 30	146	May 6	Sept. 30
1904	May 12	*	*	May 12	*
1905	May 24	*	*	May 24	*
1906	May 28	*	*	May 28	*
•	*	*	*	*	*
1908	May 1	Sept. 28	149	May 1	Sept. 28
1909	*	Sept. 27	*	*	Sept. 27
1910	May 16	Oct. 24	160	May 16	Oct. 24
1911	May 7	Oct. 24	169	May 7	Oct. 24
1912	June 10	Oct. 1	112	June 10	Oct. 1
1913	June 10	Sept. 23	104	June 10	Sept. 22
1914	June 17	*	*	June 17	
1915	May 18	Oct. 9	143	May 18	Oct. 9
1916	May 20	Sept. 19	121	May 20	Sept. 19
1917	May 26	Sept. 11	107	May 26	Sept. 11
1918	May 3	Sept. 22	141	*	Sept. 22
1919	Apr. 19	Oct. 20	183	*	Oct. 19
1920	May 16	*	*	May 16	*
1921	May 17	Oct. 1	137	May 17	Oct. 1
1922	May 8	Sept. 26	142	May 8	Sept. 26
1923	May 11	Oct. 21	164	May 18	Oct. 5
1924	May 2	Oct. 21	173	May 23	Sept. 6
1925	May 27	Oct. 11	138	May 27	Oct. 10
1926	May 24	Oct. [illegible]	156	May 4	Oct. 8
1927	May 2	Sept. [illegible]	144	May 2	Sept. 22
Average Date...	May 16	Oct. 4	146	....	....

* No data.

Monthly and Annual Precipitation in Inches at Arbovale. H. S. Sutton, Observer.

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
1924	....	....	....	....	....	....	....	....	....	....	....	2.54	......
1925	3.11	1.64	3.64	2.05	2.83	2.68	6.67	1.23	3.14	5.66	3.36	1.40	37.41
1926	3.97	3.66	2.77	2.48	2.84	2.39	6.49	6.85	3.00	4.23	3.24	4.96	46.88
1927	2.36	5.36	1.47	6.85	1.69	3.72	4.31	5.72	1.15	3.72	3.31	3.61	43.27

Population.—The following table, taken from the United States Census Returns for 1920, shows the population of Pocahontas County by districts for the last three enumerations:

Minor Civil Division.	1920.	1910.	1900.
Edray District, including Marlinton town........	4,016	4,150	2,678
Greenbank District, including Cass, Durbin, and Thornwood towns..........................	6,048	6,128	2,496
Huntersville District..........................	1,729	1,407	1,177
Little Levels District, including Hillsboro town..	3,209	3,055	2,221
Totals for County......................	15,002	14,740	8,572

From 1900 to 1910 Pocahontas County had an increase in population of 72 per cent. which was largely due to the construction of the railroad. Marlinton, the county-seat, had a population of 1,177 in 1920.

Products.—The principal animal products of Pocahontas County are cattle, sheep, horses, chickens, swine, mules, and goats, in the order named.

The principal agricultural products are corn, oats, wheat, hay, potatoes, apples, peaches, grapes, and rye, in the approximate order named.

The principal manufactured products are lumber and leather. Under the former the Cherry River Boom and Lumber and the West Virginia Pulp and Paper Companies are the large producers with several smaller companies operating in the county. Large quantities of leather are shipped from the Greenbrier Tannery of the Union Tanning Company at Marlinton and the Pocahontas Tanning Company at Frank.

Coal has been exploited very little in the county and there are at present no producing mines. Limestone has been used extensively in road building with smaller amounts for agricultural purposes.

The mineral waters have not yet been developed. The fine flow of pure water at Minnehaha Springs is used occasionally during the summer months for bathing while a very small part of the water from the Prichard Spring near Dunmore is bottled and trucked to Cass for drinking purposes.

Property Valuation.—According to Hon. Sam. T. Mallison, State Auditor, the following table shows the property valuation for Pocahontas County for three years:

	1925.	1926.	1927.
Real Estate	$ 9,591,380	$ 9,337,170	$ 9,106,690
Personal Property	4,837,835	4,498,290	4,342,190
Public Utilities	2,875,545	2,771,915	2,679,035
Total	$17,304,760	$16,607,375	$16,127,915

Postal Service and Village Populations.—Pocahontas County is served partly by railway mail and partly by star route and rural free delivery carriers. City delivery is afforded twice daily at Marlinton, the county-seat. The following table, compiled from the United States Postal Guide, with estimates of populations mainly by Calvin Price of Marlinton, shows the number of post-offices in the county. The parenthetic figures following the names of offices indicate the number of rural free delivery routes emanating therefrom:

Village.	Population.	Village.	Population.
Arbovale	50 (e)	Linwood	32
Bartow	165 (e)	Lobelia	56
Beard	40 (e)	Mace	20
Boyer	50 (e)	Marlinton (1)	1575 (a)
Buckeye	60 (e)	Mill Point	63 (e)
Burr	10 (e)	Minnehaha Springs	75 (e)
Cass	1195 (a)	Nottingham P. O. (Boyer Sta.)	45 (e)
Clover Lick	85	Onoto	30 (e)
Dunmore (2)	76	Raywood	166 (e)
Durbin	700 (e)	Seebert	75
Edray	56	Slaty Fork	60 (e)
Frank	400	Spice	20
Frost	66	Stony Bottom	86 (e)
Green Bank	110	Thornwood P. O. (Winterburn)	52 (e)
Hillsboro	215 (a)	Watoga	33 (e)
Hosterman	57 (e)	Woodrow	69 (e)
Huntersville (1)	80 (e)		
Jacox	15		

(a) Actual count.
(e) Estimated.

TOWNS AND INDUSTRIES.

Marlinton.

Marlinton, the county-seat of Pocahontas County, is beautifully situated on the flood-plain, at the junction of Knapp Creek and Greenbrier River, in the south-central part of the county, with an elevation of 2,123 feet above sea-level. It is the site of the oldest settlement in Pocahontas County, made by Stephen Sewell and Jacob Marlin during the winter of 1750-51, and was known as Marlin's Bottom until 1887. In December, 1890, Colonel John T. McGraw purchased the farms known as Marlin's Bottom (the name of the post-office had been changed three years before) for a town site. It was laid off in town lots and widely advertised "as a place where a town would be built". The Pocahontas Development Company was chartered to promote the town. It offered $5,000 to be applied on a new court-house if the people would change the county-seat from Huntersville to Marlinton. In 1891, by a special election this change was authorized and the removal was followed by the construction of the Greenbrier Division of the Chesapeake & Ohio Railway. The latter work began in June, 1899, and was completed in 1905, but the first operation of trains over this branch in Pocahontas County was in December, 1900. Since the completion of the railroad the town has continued to grow. According to Harris[1] the town was chartered in 1900 under Chapter 47 of the Code of 1899, with election to be held annually in January.

Located at Marlinton is a well-equipped graded school, the Edray District High School, two large churches, and three banks, The Bank of Marlinton, The First National Bank, and The Farmers and Merchants Bank. The town has two weekly papers, The Pocahontas Times, established in 1881, and The Marlinton Journal, established in 1918. The Greenbrier Tannery of the Union Tanning Company is located here as well as S. B. Wallace & Co., Wholesale Druggists, and several lumber companies. The population of Marlinton in 1900 was 171; in 1910 it was 1,045; and in 1920 it was 1,117.

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[1]John T. Harris, W. Va. Legislative Handbook, p. 947; 1924.

Greenbrier Tannery.—The Union Tanning Company, with head offices in New York, has operated a tannery at Marlinton since about 1901, except during the latter part of 1927 and the early part of 1928, when the original plant was burned. After a short delay, however, a new and up-to-date tannery was built upon the original site. According to S. N. Hench, local superintendent, both tanbark and extract are used in tanning; its present daily capacity being approximately 600 hides; about 150 men, both skilled and unskilled, are employed, with an approximate pay-roll of $120,000 per year. This tannery has a reputation for producing a very fine grade of leather, which is known by the trade name of "Greenbrier", and is in great demand by the leather industry. The finished product is shipped almost entirely to Boston, Massachusetts. (See Plates IV and V).

Durbin.

Durbin is situated at the junction of the East and West Forks of Greenbrier River along the Staunton and Parkersburg Pike, being located upon the terrace of these two streams with an elevation of 2,730 feet. Here the Greenbrier Division of the Chesapeake and Ohio Railway connects with the Durbin Branch of the Western Maryland Railway and makes Durbin the shipping and mercantile center for the northern end of the county. The town was chartered June 20, 1906, by the Circuit Court, under Chapter 47 of the Code of 1899, with elections to be held annually in January. The population in 1920 was 422.

Cass.

Cass is situated along the Greenbrier River near the mouth of Deer Creek, just east of the southern end of Cheat and Back Allegheny Mountains, with an approximate elevation of 2,450 feet. According to Harris it was incorporated in 1902, its population by the Census of 1920 being 1,195, and hence the largest town in the county. It is situated on the first and second terraces of the river. It is served by

PLATE II.—Seneca Trail (State route 24) between Mill Point and Hillsboro. Two miles of straight road and said to be the longest stretch of straight road in the State. (Photo. by Paul H. Price).

PLATE III.—Marlinton, situated on a joint terrace between Knapp Creek and Greenbrier River, with a beautiful development of the Harrisburg Peneplain. (Photo. by Paul H. Price).

PLATE IV.—View of Greenbrier Tannery at Marlinton. This plant burned in 1927 but has been rebuilt on the same location. (Photo by Union Tanning Co.)

PLATE V.—Settling Ponds of the Greenbrier Tannery at Marlinton. (Photo. by Union Tanning Co.)

the Chesapeake and Ohio Railway and by a lumber railroad of the West Virginia Pulp and Paper Company. The population is composed largely of employees of the West Virginia Pulp and Paper Company which operates a local lumber mill.

Hillsboro.

Hillsboro is the oldest town* in Pocahontas County from the standpoint of incorporation, having been chartered in 1886. It is located upon a broad level plain in the southwestern part of the county, with an elevation of 2,302 feet, being situated in the midst of the finest limestone farming area in the county and being largely supported by the products from these farms. For many years Hillsboro was the educational center of that region and supported the Hillsboro Academy.

*The town of Huntersville was incorporated December 18, 1822, by the Virginia General Assembly, Acts of 1822-23, p. 94, but charter was surrendered at a date unknown—R.C.T.

CHAPTER II.

PHYSIOGRAPHY.

INTRODUCTION.

Pocahontas County represents one of the most interesting local areas for physiographic study in the State, being the source or near the source of many of the major streams of the eastern United States. The present topographic features are the results of movements of the earth's crust followed by ages of erosion. The eastern half of the county exhibits excellent examples of mountains due to folding and followed by erosion while the western half presents rugged mountain topography as the result of ages of cutting away by small streams. The rocks of Pocahontas County—sandstone, limestone, and shale—are all of sedimentary origin, that is, deposited in water of varying depths and salinity, while the coals represent abundant vegetation spread over a low-lying swamp area but nevertheless in sufficient water to prevent decomposition, which would follow if not retarded by the formation of a toxic acid that interrupts bacterial action.

After this deposition had taken place crustal movements caused the entire area to be elevated above sea-level. During Cretaceous or Jura-Cretaceous time the area was more or less perfectly peneplaned and later uplifted with some warping. Again erosion was at work and resulted in peneplanation in the less resistant areas with mature dissection of the hard rocks of more resistant areas. The time of this leveling is attributed to the Tertiary. The whole has since been uplifted and further dissection is now in progress. In many of the adjoining areas intermediate peneplanation has been noted. In the area under discussion intermediate levels of prominence were noted, most of which are the results of resistant sandstone strata which retarded erosion, but which could not be definitely proved as peneplain levels.

The rocks of Paleozoic age in this area range from near the base of the Silurian (the Medinas are considered as of Silurian age by the West Virginia Geological Survey) to the basal portion of the Kanawha Group of the Pottsville Series. The oldest rocks exposed are sandstones and shales of the Red Medina Series. Their entire thickness is not visible but approximately 400 feet of sandstone and shale can be seen along the Knapp Creek gorge near Minnehaha Springs. Immediately over the Red Medina Series is the 50-foot White Medina quartzite, which, because of its resistant character, is a mountain maker as evidenced by Beaver Lick, Brushy, Browns, and Michael Mountains. Following the Medinas comes the Clinton Series made up of quartzites, Iron Sandstone, and shale, with thin limestones. These quartzites are also ridge makers and usually parallel the Medina folds. The Silurian limestones because of their soluble character are usually valley makers unless protected by the adjacent rocks. The Oriskany Sandstone and overlying chert with a thickness of 100 to 125 feet are exposed on either side of the Beaver Lick-Browns-Michael Mountain and are standing almost vertical as prominent ridges. The overlying shales—Marcellus, Hamilton, and Genesee—because of their weak character, are found only in the valleys paralleling the above-mentioned major fold, that is, Knapp Creek from Frost to Minnehaha Springs, Browns Creek, Cummins Creek, Douthat Creek, and Shock Run. The remaining Devonian Shales—Portage, Chemung, Catskill—with an approximate thickness of 5,000 feet, have an increasing amount of sandstone and hence are more resistant. Although capped in places with Pocono Sandstone, Allegheny, Burner, Little, Thorny Creek, Buckley, Pyle, Lockridge, and Middle Mountains are characteristic of these series. The Pocono Series (50-500 feet) frequently caps high mountain areas. The Greenbrier Limestone (300-550 feet), Maccrady Series (50 feet), and the Mauch Chunk Series (1,500 feet) because of their weak and soluble characters either make valleys or occur in steep-sloping hills, while the Pottsville Series with several resistant sandstones and conglomerates covers much of the higher plateau region.

PHYSIOGRAPHIC PROVINCES.

The eastern United States is divided into three main physiographic provinces* from east to west, namely, the Coastal Plain, Piedmont, and Appalachian. Pocahontas County is entirely within the latter, or Appalachian, which is in turn subdivided from east to west into the Blue Ridge, Great Valley, Allegheny Ridges, and Allegheny Plateau. The Blue Ridge subdivision including the Blue Ridge and Catoctin Mountains and intervening territory, and the Great Valley including the great limestone valleys from the Blue Ridge to the Alleghenies, are both entirely east of Pocahontas County. The county is entirely contained within the Allegheny Ridges and Allegheny Plateau. The former includes the sharp mountains of the southeastern half and the Allegheny Plateau includes the low-angle or nearly horizontal rocks from the Allegheny Ridges to the west.

Wright[1] has recently expressed the view that the Allegheny Front has been erroneously designated as following the Allegheny Mountain in this region by Darton in the Monterey Folio, and holds that the true "Front" should not be located in the midst of ridges but at the southeastern margin of the Plateau. If that is the proper interpretation the area under discussion falls within the limits of the Allegheny Plateau and the Allegheny Ridges subdivisions of the Appalachian Province. The boundary line follows roughly the Greenbrier River to the northern end of the county where it swings slightly to the east to the Allegheny Mountains in Pendleton County. In many places the rim rock is a southeastward escarpment 1,500 to 2,000 feet high. Both subdivisions trend northeast and southwest in conformity with the structure of the rocks.

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*The usage herein followed, as in previous West Virginia Reports, is that of Maryland. See Cleveland Abbe, Jr., Maryland Weather Service, Vol. I, Plate III, opp. p. 72; 1899.

[1]Frank J. Wright, The Physiography of the Upper James River Basin in Virginia, Bull. No. XI, Virginia Geol. Sur., p. 13; 1925.

THE EARLIEST RESTORED SURFACE.

The oldest topographic feature represented in Pocahontas County is that of the Schooley Peneplain and its monadnocks. So far as determinable there is no element in its drainage that could not have been formed during this cycle of erosion or later cycles.

When an area so vast (as represented by this peneplain) is uplifted some warping will occur. This feature was early recognized by Hayes and Campbell[2] and later by Wright[3]. As many of the major streams of the eastern United States, that is, Potomac, James, Greenbrier, Gauley, Elk, Monongahela, and Cheat Rivers, have their source in or near this county, it is evident that this area was near the maximum elevation of this warped peneplain. At present, this surface has been largely destroyed by deep valleys cut below it, with occasional high peaks rising above it as monadnocks. Furthermore, in folded areas the resistant formations adjacent to the less durable ones result in structural features irrespective of erosion levels. All these conditions make difficult the definite recognition of the peneplain level. However, by close observation in the field supplemented by later detailed study of an accurate topographic map, the peneplain was determined in most cases with reasonable accuracy.

THE SCHOOLEY PENEPLAIN.

An examination of the topographic features of Pocahontas County reveals three important levels, the upper peneplain or Schooley, (sometimes called Upland), the Harrisburg Peneplain, (sometimes called Valley or Tertiary). and the present major stream levels. The Schooley Peneplain is represented by the crests of Allegheny Mountain on the east, Burner, Cheat, and Back Allegheny on the north, and the general plateau region on the west with elevations ranging from 4,000 to 4,600+ feet, there being no apparent remnants in the center of the county. The local area represents the maxi-

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[2]Hayes, C. Willard and Campbell, M. R., Geomorphology of the Southern Appalachians. Nat. Geog. Mag., Vol. VI, pp. 63-126; 1894.
[3]Op. cit.

mum uplift at the close of Jura-Cretaceous time as evidenced by the drainage of the present major streams. This zone of maximum uplift parallels the mountain ranges and roughly that of the Greenbrier River sloping to the northwest and southeast. In Gilmer County it descends to 1,400 feet, in Summers County to approximately 3,000 feet, and on Patterson Creek Mountain at the Mineral-Grant-Hampshire-Hardy County corner to 2,750 feet. The Schooley Peneplain is easily discernible from the Harrisburg Peneplain which is itself dissected by streams to depths of 400 to 500 feet. Therefore the topography now reveals five distinct features as does the adjoining county of Pendleton[4] to the northeast:

(1) Monadnocks on the Schooley Peneplain.

(2) Remnants of the Schooley Peneplain.

(3) Monadnocks on the Harrisburg or Tertiary Peneplain.

(4) The Harrisburg Peneplain.

(5) Valleys cut below the Harrisburg Peneplain.

The Schooley Peneplain is considered the equivalent of the high peneplain of New Jersey where it was named by Prof. W. M. Davis. It is generally regarded as Jura-Cretaceous in age. In the area under discussion the data necessary to determine its age are not available. It has, however, been correlated with the same level to the adjoining State boundaries.

MONADNOCKS ON THE SCHOOLEY PENEPLAIN.

Even though the Schooley Peneplain reached a high degree of perfection there remained some few remnants above the general level. These monadnocks probably owe their existence to the more resistant rocks and greater distance from main drainage areas, the reason for this belief being that these monadnocks are capped by the resistant Pocono and Pottsville Sandstones and are located near the head of the main drainage lines.

Bald Knob.—The most striking monadnock in the region is Bald Knob on Back Allegheny Mountain in the Plateau

[4]Pendleton County Report. Physiography of Pendleton County by Paul H. Price, Chapter II; 1927.

region but near the divide of this region and the Allegheny Ridges region. It now stands 242 feet above the general level of the Schooley Peneplain in that area which here reaches an elevation of 4,600 feet. It is capped by the resistant Pottsville Conglomerate.

Big Spruce Knob.—Big Spruce Knob stands in the western part of the county with an elevation of 4,695 feet or roughly 100 feet above the general level of the Schooley Peneplain. In that it is capped by the Pottsville Series and lies between the main line of drainage it would seem to represent a monadnock.

LOCAL REMNANTS OF THE SCHOOLEY PENEPLAIN.

Allegheny Mountain.—Allegheny Mountain presents what is not only the best example of this peneplain in the county, but what is probably one of the best in the State. It can be seen to the best advantage near "Top of Allegheny" where it is crossed by the Staunton and Parkersburg Pike. It is true that the crest is capped by the resistant Pocono Sandstones lying in practically a horizontal position, but as pointed out by Wright[5] both sides are beveled, evidencing its true peneplain character. The mountain is a broad surface with slight dissection but preserving an even sky-line for several miles. The average elevation is approximately 4,400 feet.

Cheat Mountain.—The high, precipitous Back Allegheny and Shavers Mountains combined, whose eastern edge forms the boundary between the Plateau and the folded mountains, are good examples. The striking escarpment rises some 1,500 to 2,000 feet above the main drainage. In the Bald Knob and Thorny Flat region it is strongly developed at elevations of approximately 4,600 feet. The cap rocks in this area are of the Pottsville Series lying in a synclinal position with edges beveled by erosion. Shavers Fork follows this basin to the north slightly entrenched below the peneplain level.

Other Remnants.—Although not so well preserved but nevertheless local remnants are many points in the western

[5]Op. cit., p. 13-14.

area of the county. This area is now greatly dissected by streams that have cut deep valleys below the Schooley level but many points, such as Spruce Knob, Black Mountain, and Gauley Mountain, capped by Pottsville rocks with westward slopes, are remnants of this upper peneplain. The elevations vary from 4,400 to 4,600 feet.

WARPED CHARACTER OF SCHOOLEY PENEPLAIN.

As pointed out in the Pendleton County Report[6] of the Survey when so vast an area as represented by this peneplain is elevated some warping is bound to occur. In the area under discussion this zone of maximum uplift extends along an axis trending northeast-southwest roughly marking the watershed of the present major streams, the slope descending to the northwest and southeast. Wright[7] believes that during this warping at least two domes were formed in the local area, that is, Bald Dome and Spruce Dome. "Bald Dome.—This is a broad dome having an elevation of 4,600 feet with its longer axis running northeast-southwest, parallel to the axis of the major uplift." "Spruce Dome.—Spruce Dome is located in Pocahontas County about 20 miles southwest of Bald Dome in the region of Big and Little Spruce Knobs. It is 4,600 feet in elevation or about the same as the preceding dome." Full endorsement of his views by other geologists, however, is not yet apparent.

HARRISBURG PENEPLAIN.

This peneplain, sometimes called Valley, is of Tertiary age and was named from Harrisburg, Dauphin County, Pennsylvania. It is well developed along the Greenbrier River with an elevation of approximately 2,500 feet or roughly 400 feet above the river and from 1,500 to 2,000 feet below the Schooley. It is a noticeable fact, however, that in regions where the Schooley Peneplain is well developed the Harrisburg Peneplain is poorly developed and vice versa. Hence

[6]Paul H. Price, Physiography of Pendleton County; 1927.
[7]Op. cit., pp. 15-16.

the best development of this peneplain would be in the central and south-central part of the county.

In this peneplain, complete base-leveling did not take place as it did in the former. It is only in the area of less resistant rocks that anything like a peneplain was reached. For this reason its best development would be expected in the limestone and shale areas, and hence it is along the Greenbrier River and along the eastern margin of the Greenbrier Limestone Series that it shows its best development. It can be seen to the best advantage from a point on Kee Flats looking to the north of Marlinton (See Frontispiece and Plate III). It is also represented by Jericho Flat and is particularly well developed in the area around Hillsboro. Between Hillsboro and Marlinton many small rounded pebbles were found at this level. In the eastern part of the county it is best developed in the shale and limestone areas along Knapp Creek where its elevation averages around 3,000 feet.

It is true that there are many points coming within these limits that stand above the general Harrisburg Peneplain level and these may represent the Weverton Peneplain, but they may also be accounted for as resistant sandstone and quartzite strata standing as monadnocks above the general Harrisburg level.

STREAM TERRACES.

Stream terraces are found in many localities along the major streams of Pocahontas County. They can be seen at the present time to the best advantage near the junction of minor streams transverse to the main drainage. They are well developed, however, in longitudinal shale valleys. Well-defined examples are found along Knapp Creek at Huntersville, Minnehaha Springs, and Frost, and also along Sitlington Creek at Dunmore and east of Mt. Pleasant School. Probably the best and most extensive terraces are to be found along Deer Creek near Green Bank and Arbovale. Along the Greenbrier River well-defined terraces can be seen at Seebert, Mill Point, Buckeye, Marlinton, Fair-Grounds, Clover Lick, and Dunmore. Practically all of these points are located upon terraces.

Flood-plain terraces are the most common type. The stream cuts its channel below the alluvial material that constitutes the flood-plain. These flood-plains vary from 5 to 15 feet in height above the stream.

Ordinarily shale is the prevailing rock type in which the terrace is cut but occasionally sandstone layers are encountered. At Minnehaha Springs the hotel rests upon a terrace that rises fifty feet above Knapp Creek. This terrace is located upon the vertical Oriskany Sandstone sheared off by stream erosion. Terraces are often quite flat but usually the back of the terrace rises from 5 to 15 feet above the front. This is particularly true in the terraces south of Frost.

In the area under discussion three distinct terraces are evident above the flood-plain. These vary at any given point from one to three, and there is such variation in elevation that definite correlation over any distance is difficult. They range in elevation from 10 to 195 feet, the latter elevation being along Stamping Creek at Mill Point, 1½ miles from the river.

The following terrace levels, determined by barometer unless otherwise stated, show the difficulty of making definite correlations over long distances:

Stream Terraces along Greenbrier River.

Terrace.	Seebert.	Mill Point.	Buckeye.	Marlinton	Fair-Grounds.	Clover. Lick.	Durbin.
Third.........	2165	2240	2240	None	None	2450	None
Second........	2135	None	None	2215	None	None	None
First.........	None	None	None	None	2190-95	2340	2750
Flood-plain....	2050	2050-55	2100	2123	2150	2280	2710
Stream........	2040	2045	2090	2115	2140	2270	2700

Stream Terraces Along Knapp Creek.

Terrace.	Marlinton.	Huntersville.	Minnehaha Springs.	1¼ mi. S.W. of Sunset School.
Third	None	None	None	None
Second	2215	2335	None	2330
First	None	2275	2360	2300
Flood-plain ..	2123	2235–40	2320	2280
Stream	2115	2230	2310	2275

The elevations of the terraces in the following table taken from Wright[5] were determined with a hand-level:

[5]Op. cit., p. 40

Terrace.	One mile south of Frost.	Diff.	Frost.	Diff.	Four miles north of Frost.	Diff.
Third	101	....	109.65	....	70	....
	....	35	....	48.20	....	10
Second	66	....	61.45	....	60	....
	....	44	....	45.05	....	40
First	22	....	16.40	....	20	....
	....	16	....	11.35	....	10
Flood-plain ...	6	....	5.05	....	10	....

Along Sitlington Creek near Dunmore a well-defined terrace can be seen south of the State road 60 feet above the level of the creek.

Probably the most extensive terraces in the county are found in the vicinity of Green Bank. Here the terraces are broad and horizontal, displaying vast quantities of gravel and boulders, and there are three distinct levels but with only slight differences in elevation. The stream has an elevation of 2,660 feet, Flood-plain 2,665-70 feet, First Terrace 2,700 feet, Second Terrace 2,735 feet, and a Third Terrace at 2,750 feet.

In conclusion it can be stated that the stream terraces are of two general types; namely, flood-plain terraces or terraces that are the result of the stream entrenching itself in the alluvial flood-plain, and rock-defended terraces as described by Wright[9], the latter being terraces cut in rock like shale but "defended" by a more resistant rock such as sandstone or quartzite. This type is common in folded regions. Examples of the former are at Green Bank and Frost while the latter can be seen at Minnehaha Springs, Seebert, Mill Point, Marlinton, and Clover Lick.

PRESENT TOPOGRAPHIC FEATURES.

The general relief of Pocahontas County can be divided roughly into two main divisions; namely, the region east of the Greenbrier River or folded area, and the other west of the Greenbrier River or slightly warped area. The present

[9]Op. cit.

topographic features are the result of orogenic movement followed by long ages of erosion. The present streams have been at work for thousands of years and their tireless effort has dissected the nearly level plain into the present rugged topography. A portion of the water that falls as rain or snow sinks in the ground, while another portion is carried away by the streams. This produces two agencies of erosion, the first corrasion, or the mechanical wearing away of the rocks, and the second, solution. This running water in streams carries sand and gravel in suspension and acts as an abrasive, wearing down the rocks over which it passes, thus forming the hills and valleys. Ordinarily solution plays only a small part except in limestone areas. A good example of the latter can be seen in the vicinity of Lobelia and Hillsboro.

The rate of flow of a stream is determined by its gradient, or the steepness of its descent and the volume of water which it carries. Clear water flowing over bare rocks has little erosive power. Obviously it is during the flood stages, when the volume is greatest and the stream flows more swiftly, that the greatest amount of sand and gravel is transported. These sediments are the tools which grind away the bed rock.

Underground water, or that which sinks into the ground, has little erosive activity as compared with surface drainage, but is active chiefly as an agent of solution. It is by the slow infiltration of ground water through the pore spaces and crevices that contact is reached with the soluble components that surface water can not touch. However, as the surface water erodes in one place and deposits in another, so ground water in one place dissolves and deposits in another. The solution, however, greatly exceeds the deposition and makes the rocks through which it passes more porous. Various types of rock are affected differently. In sandstone the cementing material is removed, making the remainder more easily eroded by running water. Shale being practically impervious to ground water is little affected. In limestone complete solution often takes place leaving caves, sink-holes, and underground channels. When complete channels have been cut as in the vicinity of Lobelia and Jacox, the ground water travels like surface streams, and corrasion as well as solution takes place. The corrasive powers of such streams are small except in a few cases, as most underground streams are clear. Some, however, with more open inlets from the surface, do carry much sediment after rains as can be seen by muddy springs.

The type of relief produced in a region that has been elevated depends upon several factors. These in the order of their importance are altitude or elevation above sea-level, stratigraphy or kinds of rock, structure or position of rock, position of drainage courses, and climate.

The elevation above sea determines the degree of relief that may be developed but if given sufficient time nearly complete base-leveling will take place. Intermediate stages are determined by the kind and position of strata. Non-resistant rocks like shale erode more easily than sandstone or limestone while the stream courses are often determined by the position of the rocks. Rainfall as the chief climate factor not only influences the amount of sediment carried off but also controls the vegetation that will flourish and the latter is an important element in the retardation of erosion.

As a result of these varied agencies we have the present rugged and complicated relief. On the east and north we have high folded mountains paralleled by the major streams with minor streams running off at right angles. On the west we have the elevated plateau region greatly dissected by streams following in general the slope of the strata.

The highest point in the area is Bald Knob on Back Allegheny Mountain with an elevation of 4,842 feet. The second high point is Thorny Flat five miles to the southwest at the junction of Back Allegheny and Cheat Mountains with an elevation of 4,839 feet. This plateau region averaging above 4,600 feet in elevation is capped by the Pottsville Conglomerate. Other high points in the county are Spruce Knob on Red Lick Mountain, 4,710 feet; Mace Knob, 4,705 feet; Big Spruce Knob, 4,695 feet; Elleber Ridge on Allegheny Mountain, 4,602 feet; Black Mountain, 4,600 feet; Briery Knob, 4,518 feet; and Gibson Knob, 4,415 feet. The lowest point in the county is where the Greenbrier River crosses the Pocahontas-Greenbrier County line with an elevation of 1,952 feet above sea-level.

Allegheny Mountain.—Allegheny Mountain, the crest of which marks the boundary line with Virginia, extends the entire length of the county, a distance of some 55 miles. It is made up of one main, meandering crest line with many long spurs and lateral ranges. The highest, and what is probably the most important, pass in this crest line is along the Staunton and Parkersburg Pike with an elevation of 4,200 feet at "Top of Allegheny". At the head of Galfred Run there is a rather sharp depression to 3,675 feet, and along the road northeast of Frost a diagonal gap crosses the range at an elevation of 3,158 feet. It continues to rise to the south to Paddy Knob with an elevation of 4,494 feet and then descends with a gradual fall to the Marlinton-Mountain Grove road (State route 43) with an elevation of 2,500 feet, thence with a gradual rise to Hightop near the Greenbrier County line with an elevation of 3,645 feet. This mountain is composed principally of the Upper Devonian sandstone and shale with Pocono sandstone capping some of the higher points.

Beaver Lick-Browns-Michael Mountains.—Lying between Allegheny Mountain and the Back Allegheny Mountain area are a number of ranges of considerable prominence, Beaver Lick Mountain entering from Greenbrier County to the south with its extension in Brushy Mountain, north of which are Browns and Michael Mountains and other smaller ridges which terminate in a wide, level valley north of Green Bank. This series of ranges makes one large fold composed of several small folds the backbone of which is the White Medina quartzite. This range is crossed by Sitlington Creek south of Michael Mountain in a rather low gap and again by the deep gorge of Knapp Creek at Minnehaha Springs which terminates Browns Mountain on the south. On the north end of Beaver Lick Mountain the White Medina quartzite rises in a vertical cliff to 3,662 feet, while a continuation of the same rock marks the southern end of Michael Mountain with an elevation of 3,652 feet.

Buckley-Marlin-Thorny Creek-Little Mountains.—Just east of the Greenbrier River lies a series of even-crested short ranges separated by gaps of greater or less depth. They bear the names from south to north of Pyle, Buckley, Marlin, Thorny Creek, Thomas, Peters, and Little Mountains, and Sandy Ridge. Their crests rise rather uniformly with an elevation of approximately 3,400 feet. They are in most cases capped by the Berea conglomerate of the Pocono Series dipping gently to the west.

Yew-Droop-Gauley Mountains.—West of the Greenbrier River is a narrow shelf due to the hard Pocono sandstone extending nearly the length of the county. This narrow shelf, represented by Kee Flats, Jericho Flat, and others of that level, is separated at many points by transverse streams cutting through it. Above it rise the gentle limestone slopes, followed by the steeper slopes of the resistant conglomerate. **Droop Mountain** south of Hillsboro is an isolated range with a broad level top averaging 3,100 feet in elevation. It is capped by the Droop Sandstone of the Mauch Chunk Series. **Yew Mountains** are the result of a greatly dissected high plateau, made up of many smaller ranges, as Spruce, Kennison, Cranberry, Black, and Turkey Mountains, with apparently little continuity. They show a broad rough relief with deep precipitous gorges cut between them. In most cases these ranges are capped by the resistant Pottsville conglomerates, the makers of mountains and rugged topography. **Gauley Mountain** might be said to be a continuation of the same range with minor ranges in Tea Creek and Red Lick Mountains on the south and terminated by Laurel Creek of Williams River. This range is also capped by the Pottsville conglomerates with a gentle slope to the northwest.

Cheat-Back Allegheny-Shavers Mountains.—Between the headwaters of Elk River and Greenbrier River stands the very abrupt front of the Back Allegheny and Shavers Mountains, which rises 1,800 feet in a very imposing face surmounted by cliffs of sandstone and conglomerate. These two ranges are separated by a comparatively low pass at the Randolph-Pocahontas County line along the Staunton and Parkersburg Pike five miles northwest of Durbin with an elevation of 3,760 feet.

At the top of Back Allegheny Mountain there is a plateau containing a shallow basin traversed by Shavers Fork of Cheat River. The western margin of this plateau is known as Cheat Mountain, which also presents a precipitous face of cliffs to the west. The front of Back Allegheny Mountain has been deeply indented by Leatherbark Run cutting within one quarter of a mile of Shavers Fork. This series of ranges is also capped by the resistant Pottsville rocks. It is on Back Allegheny Mountain that the highest elevation of the county is reached on Bald Knob with an altitude of 4,842 feet. Thorny Flat at the southern junction of Back Allegheny and Cheat Mountains also attains an elevation above 4,800 feet.

Burner Mountain.—Burner Mountain, located in the northern end of the county between the East and West Forks of Greenbrier River, marks the barrier or watershed between these two forks. It is composed mainly of Upper Devonian rocks with an occasional point retaining the basal Pocono member. The sides are cut by transverse streams to join the main drainage lines. It is terminated on the south where East Fork of Greenbrier River cuts across its southern end to join the West Fork to form Greenbrier River at Durbin. It has an elevation of approximately 4,000 feet.

DRAINAGE BASINS.

A general view of the drainage system of Pocahontas County can be seen on Figure 3, and a detailed study can be made of the streams from Maps I and II, which are found in the Atlas accompanying this report, showing their relation to the topography, geology, and structure. East of the plateau region the major streams, in general, parallel the mountain ranges, while the minor streams have cut across them at right angles, a condition that prevails throughout the Allegheny Ridges region. In the Plateau region the streams have followed the lines of least resistance or down the slope of the elevated plateau at the close of Jura-Cretaceous time. Pocahontas County has the unique distinction of receiving no drainage from another county.

PLATE VI.—Cass. One of the West Virginia Pulp and Paper mill plants is located here. The town is situated upon the first and second terraces of the Greenbrier River. The rocks exposed in the valley are of Catskill age with Pocono sandstones forming the crests of the first line of ridges. (Photo. by Gay's Studio, Marlinton).

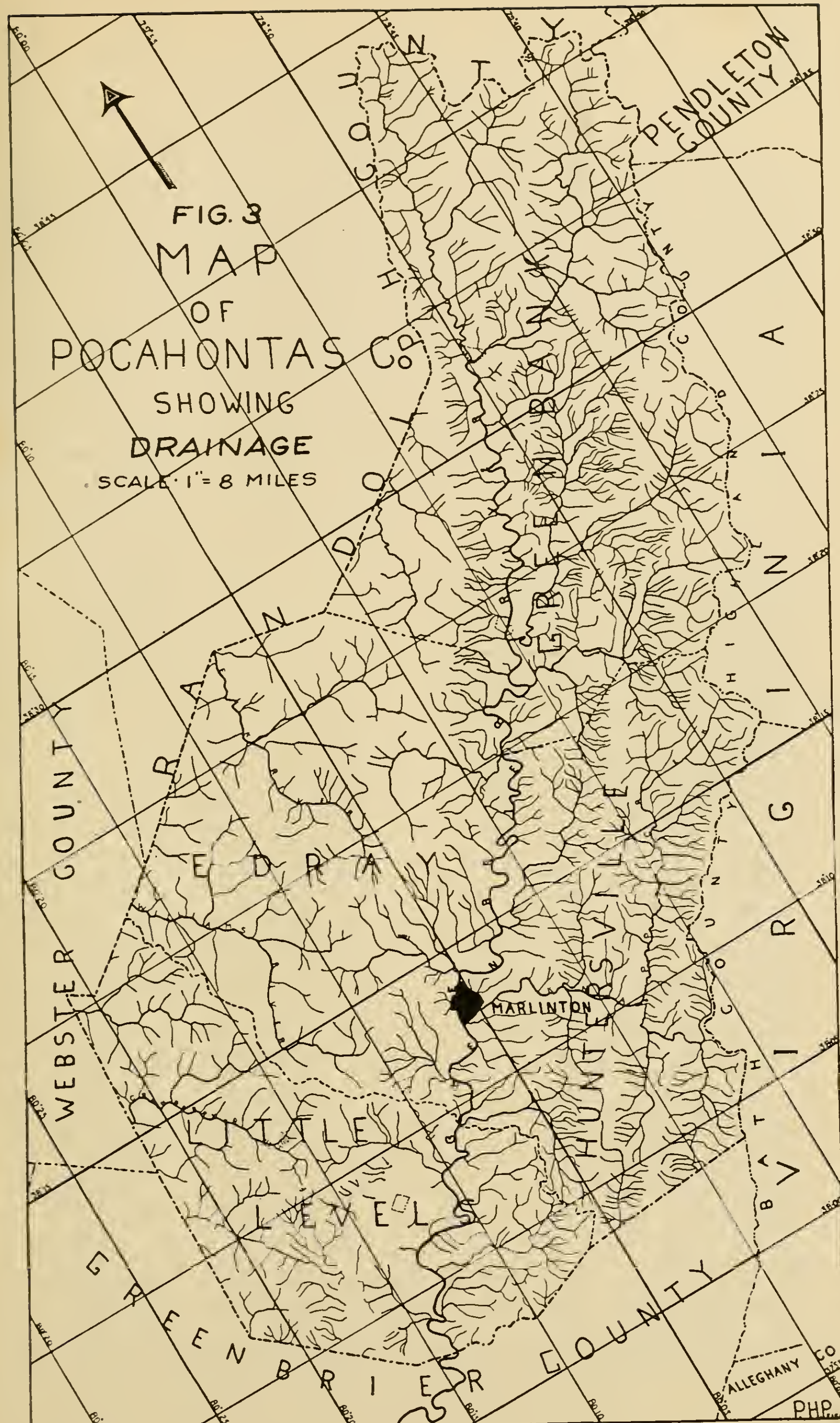

Figure 3.—Map of Pocahontas County Showing Drainage System.

TABLE OF STREAM DATA.

The following table gives a list of all the principal streams of Pocahontas County, the length of the streams as well as the air-line distance from source to mouth, also the total fall of the streams and rate of fall per mile. In the last column is given the ratio of the meander distance or total distance (T. D.) to the air-line distance (A. L. D.):

Table of Stream Data.

Streams.	Total Distance. Miles.	Total Fall. Feet.	Rate of Fall Per Mile. Feet.	Air-Line Distance Miles.	Ratio T. D. to A. L. D.
Greenbrier River, source of East Fork to mouth	164.8	2500	15.2	98.64	1.67
Greenbrier River, source of West Fork to mouth	162.9	2250	13.8	97.14	1.67
Greenbrier River, junction of East and West Forks at Durbin to mouth	144.0	1325	9.2	83.49	1.72
Greenbrier River, junction of East and West Forks at Durbin to Greenbrier-Pocahontas County line	61.6	747	12.1	41.18	1.49
Greenbrier River, source of East Fork to Greenbrier-Pocahontas County line	80.1	1672	20.9	54.1	1.48
Greenbrier River, source of West Fork to Greenbrier-Pocahontas County line	78.2	1922	24.6	54.7	1.42
Spice Run	6.1	1000	163.9	5.5	1.11
Locust Creek	3.4	135	39.7	3.3	1.03
Trump Run	2.4	935	389.5	2.3	1.04
Hills Creek	8.4	1525	181.5	5.0	1.68
Bruffey Creek	3.9	1400	358.9	3.5	1.11
Oldham Run	5.4	830	153.7	4.8	1.12
Nigh Gap Run	2.5	790	316.0	2.4	1.04
Perry Run	3.1	815	262.9	2.8	1.11
Laurel Run	8.2	1220	148.7	6.8	1.20
Mill Run	2.1	820	390.4	1.7	1.23
Rock Run	1.7	780	146.7	1.3	1.31
Island Lick Run	4.8	750	156.2	4.0	1.20
Stamping Creek	6.8	1710	251.5	5.4	1.25
Stevens Hole Run	2.5	305	122.0	1.9	1.31
Chicken House Run	2.8	790	282.1	2.8	1.00
Beaver Creek	8.6	940	114.6	6.5	1.32
Improvement Lick Run	3.6	835	231.9	3.3	1.09
Swago Creek	3.3	1295	392.4	3.0	1.10
McClintock Run	2.2	825	375.0	2.1	1.04
Buck Run	2.8	1025	366.1	2.7	1.03
Dry Creek	3.6	965	268.0	3.4	1.05
Monday Lick Run	2.5	700	280.0	2.1	1.19
Sunday Lick Run	2.4	950	395.8	2.3	1.04
Stillhouse Run	3.1	715	230.6	3.0	1.03
Knapp Creek	26.8	1560	58.2	17.76	1.51
Marlin Run	2.7	630	233.3	2.6	1.04
Spice Run	1.3	745	573.0	1.2	1.08
Cummins Creek	6.0	1000	166.6	5.5	1.09
Browns Creek	6.0	525	87.5	5.1	1.17
Barclay Run	1.4	825	589.2	1.4	1.00
Laurel Creek	9.2	750	81.5	3.6	2.55
Douthat Creek	6.3	760	120.6	5.5	1.14
Cochran Creek	4.9	950	193.8	4.2	1.16
Rider Run	1.7	510	300.0	1.7	1.00
Big Sandy Run	1.9	450	236.8	1.7	1.11
Two Lick Run	1.4	475	393.2	1.4	1.00

Table of Stream Data (Continued).

Streams.	Total Distance. Miles.	Total Fall. Feet.	Rate of Fall Per Mile. Feet.	Air-Line Distance Miles.	Ratio T. D. to A. L. D.
Lost Bottom Run	1.7	310	182.3	1.5	1.13
Widemouth Run	2.5	855	342.0	2.3	1.08
Laurel Run	1.7	280	164.7	1.6	1.06
Lockridge Run	1.4	330	235.7	1.3	1.07
Ruckman Run	2.5	575	230.0	2.3	1.08
Guy Run	2.6	450	173.0	2.4	1.08
Mill Run	2.4	490	204.1	2.1	1.14
Moore Run	3.6	660	183.3	3.3	1.09
Sugarcamp Run	4.4	790	179.5	4.1	1.07
Bird Run	3.4	1320	388.2	2.8	1.21
Price Run	1.1	285	259.0	0.9	1.22
Stony Creek	6.6	1300	196.9	5.7	1.15
Indian Draft	5.2	1060	203.8	4.8	1.08
Dry Creek	3.6	1235	343.0	3.3	1.08
Pigeon Run	1.4	875	625.0	1.3	1.07
Halfway Run	2.2	760	345.4	2.1	1.04
Brush Lick Run	2.8	455	162.5	2.2	1.27
Sideling Run	4.2	650	154.7	3.3	1.27
Lewis Lick Run	4.6	1105	240.2	4.4	1.04
Thorny Creek	9.6	1250	130.2	7.7	1.24
Little Thorny Creek	3.4	320	94.1	2.9	1.17
Laurel Run	3.3	1550	469.6	2.8	1.17
Cloverlick Creek	9.8	1580	161.2	5.3	1.84
Glade Run	3.6	1175	326.3	2.5	1.44
Laurel Run, from source of Sweet Lick Run	4.4	835	189.7	3.3	1.33
Big Run	1.9	710	373.6	1.8	1.05
Elklick Run	2.8	1200	428.5	2.3	1.22
Woods Run	2.8	1450	517.8	2.0	1.40
Sitlington Creek, from source of Left Prong	14.5	1980	136.5	10.9	1.33
Thomas Creek	6.0	900	150.0	4.8	1.25
Moore Run	2.7	200	74.1	2.3	1.17
Gum Branch	3.5	625	178.5	2.7	1.29
Shock Run	3.9	1380	358.3	3.6	1.08
Thorny Branch	3.8	450	118.4	3.2	1.18
Jakes Run	3.2	1325	414.1	2.8	1.12
Stony Run	3.3	1400	424.2	2.9	1.13
Galfred Run	6.1	1125	184.4	4.5	1.35
Left Prong	3.2	1250	390.6	2.7	1.18
Moses Spring Run	2.9	1375	474.1	2.4	1.21
Deer Creek	17.4	1035	59.4	13.1	1.33
North Fork	11.9	1570	131.9	9.55	1.24
Rosen Fork	3.5	350	100.0	2.85	1.23
Cooper Run	3.2	325	101.5	2.8	1.14
Sutton Run	2.9	1125	387.9	2.6	1.11
Tacker Fork	2.6	1250	471.0	2.5	1.04
Black Run	3.7	1085	293.2	2.95	1.25
Elleber Run	3.25	950	292.3	2.8	1.16
Griffin Run	1.6	875	546.8	1.35	1.18
Hospital Run	1.4	160	114.3	1.4	1.00
Riley Run, from source of Millstone Run	3.65	1100	301.4	2.35	1.55
Duncan Run	4.05	1240	306.1	3.45	1.17
Trimble Run	2.9	1200	413.7	2.7	1.07
Buffalo Run	4.2	1075	255.9	3.5	1.20
Saulsbury Run	4.7	1050	233.4	4.2	1.12
Leatherbark Run	5.15	1900	368.9	3.3	1.56
Mill Run	2.1	1310	623.8	2.0	1.05
Deever Run	1.9	890	468.4	1.9	1.00
Cup Run	2.05	1090	531.7	1.95	1.05
Wanless Run	2.2	1255	570.4	2.15	1.02
Trout Run	2.05	1405	685.3	2.00	1.02
Allegheny Run	2.7	1975	731.4	2.3	1.17
Brush Run	6.7	770	114.9	5.0	1.34
East Fork, Greenbrier River	18.8	1175	62.5	14.0	1.34
Johns Run	3.55	680	191.5	3.0	1.18
Little River	7.8	1500	192.3	6.25	1.25
Buffalo Fork	5.1	660	129.4	4.9	1.04
Big Run	1.8	455	252.7	1.7	1.06
Old House Run	1.8	540	300.0	1.75	1.03
Reservoir Run (Hollow)	2.2	800	363.6	2.0	1.10

Table of Stream Data (Continued).

Streams.	Total Distance. Miles.	Total Fall. Feet.	Rate of Fall Per Mile. Feet.	Air Line Distance Miles.	Ratio T. D. to A. L. D.
Rambottom Run	1.05	570	542.8	1.0	1.05
Gum Cabin Hollow	2.0	840	420.0	1.9	1.05
Fivemile Hollow	2.5	810	324.0	2.35	1.06
Poca Run	3.1	900	290.3	2.4	1.29
Long Run	2.7	525	194.4	2.4	1.25
Grassy Run	2.2	530	240.9	2.1	1.05
Lick Run	1.9	400	210.5	1.85	1.03
Walderman Run	2.15	500	232.5	1.9	1.13
Bearwallow Run	1.8	630	350.0	1.6	1.12
Campbell Run	1.25	600	480.0	1.2	1.04
Mullenax Run	2.8	630	225.0	2.35	1.19
Abe Run	2.6	520	200.0	2.4	1.08
Burning Run	2.45	390	159.1	2.3	1.06
Simmons Run	1.65	360	218.1	1.55	1.06
Bennett Run	1.5	180	120.0	1.45	1.03
West Fork, Greenbrier River	16.9	925	54.7	13.0	1.30
Mountain Lick Creek	4.7	930	197.8	3.8	1.23
Fill Run	1.85	1180	637.8	1.65	1.12
Little River of West Fork	8.9	1050	117.9	6.8	1.31
Span Oak Run	2.25	670	297.7	2.25	1.00
Clubhouse Run	2.35	655	278.7	1.9	1.24
Elklick Run	2.6	620	235.8	2.55	1.02
Hinkle Run	2.5	500	200.0	2.35	1.06
Mill Run	2.2	325	147.7	2.1	1.05
Gertrude Run	1.75	400	228.5	1.4	1.25
Elklick Run	3.1	875	282.2	3.0	1.03
Fox Run	2.8	580	207.1	2.7	1.04
Mikes Run	2.85	570	200.0	2.8	1.02
Snorting Lick Run	2.9	550	189.6	2.5	1.16
Anthony Creek (entire)	28.65	1470	51.3	22.7	1.26
Anthony Creek (in Pocahontas County)	3.7	1175	317.5	1.7	2.18
North Fork Anthony Creek	12.45	1195	95.9	11.4	1.09
North Fork Anthony Creek (in Pocahontas County)	5.0	825	165.0	4.4	1.14
Dry Run	1.65	1195	724.2	1.5	1.10
Wildcat Run	1.7	1150	676.5	1.4	1.21
Hamilton Lick Run	1.3	1000	769.2	1.25	1.04
Sevenmile Run	1.9	1350	710.5	1.8	1.05
Sugar Hall Run	1.4	425	303.5	1.3	1.08
Gauley River (entire)	104.0	3352	32.23	59.2	1.75
Cranberry River (entire)	32.35	2035	62.9	22.6	1.43
Dogway Fork	8.2	1435	175.0	6.2	1.32
Birchlog Run	1.75	635	362.8	1.7	1.03
Tumbling Rock Run	2.45	840	342.8	2.2	1.11
North Fork (Cranberry River)	5.9	950	161.0	4.7	1.25
Left Fork	1.85	725	391.8	1.55	1.19
Red Run	2.35	1040	442.5	2.05	1.15
Little Branch	1.5	800	553.3	1.45	1.03
Charles Creek	2.35	440	187.2	2.1	1.12
Williams River (entire)	33.2	1735	52.3	22.1	1.50
Middle Fork	10.1	1940	192.1	8.3	1.22
Little Beechy Run	1.4	750	535.7	1.35	1.04
Beechy Run	4.3	1650	383.7	3.9	1.10
Laurelly Branch	1.7	1000	588.2	1.6	1.06
Hell for Certain Branch	1.3	900	692.3	1.25	1.04
Coal Run	1.2	950	791.6	1.2	1.00
McClintock Run	1.9	925	486.1	1.8	1.05
County Line Branch	1.7	1000	588.2	1.6	1.06
Lower Bannock Shoals Run	1.4	900	642.8	1.2	1.17
Hateful Run	1.2	1175	979.2	1.1	1.09
Kins Creek	2.55	1270	498.0	2.3	1.11
Bannock Shoals Run	1.95	740	379.5	1.75	1.11
Tea Creek	5.5	1300	236.3	5.0	1.10
Lick Creek	2.1	850	404.7	2.0	1.05
Right Fork	3.5	800	228.6	3.25	1.08
Sugar Creek	2.7	1050	388.9	2.55	1.06
Little Laurel Creek	3.2	1105	345.3	3.0	1.06
Laurel Creek	4.5	315	70.0	4.1	1.09
Friel Run	2.25	775	344.4	2.1	1.07

Table of Stream Data (Concluded).

Streams.	Total Distance. Miles.	Total Fall. Feet.	Rate of Fall Per Mile. Feet.	Air-Line Distance Miles.	Ratio T. D. to A. L. D.
Day Run	2.75	780	283.6	2.65	1.04
Mountain Lick Run	1.95	425	217.9	1.8	1.08
Beaverdam Run	1.8	240	133.3	1.7	1.06
Downy Run	1.95	500	256.4	1.5	1.30
Elk River (in Pocahontas County)	13.6	1025	75.4	11.9	1.14
Dry Fork	5.1	800	156.9	4.8	1.06
Douglas Fork	1.55	370	238.7	1.5	1.03
Blackhole Run	1.45	1230	848.3	1.35	1.07
Big Run	1.6	1350	843.7	1.5	1.06
Props Run	1.7	1250	735.3	1.6	1.06
Laurel Run	2.3	965	419.6	2.05	1.12
Big Spring Fork	9.0	1115	123.9	7.5	1.20
Mill Run	1.75	420	240.0	1.65	1.06
Cup Run	1.95	600	307.7	1.9	1.03
Old Field Fork	8.8	815	92.6	8.0	1.10
Slaty Fork	4.2	1200	285.7	4.0	1.05
Mill Creek	2.6	1550	596.1	1.8	1.44
Crooked Fork	3.2	1050	328.1	2.7	1.18
Tygart River (in Pocahontas County)	2.2	1075	488.6	2.0	1.10
Shavers Fork of Cheat River (in Pocahontas County)	10.0	900	90.0	8.6	1.16
First Fork	5.0	850	170.0	4.8	1.04
Second Fork	4.1	1025	250.0	3.9	1.05
Rocky Run	2.25	505	224.4	2.1	1.07
Black Run	2.55	410	160.8	2.45	1.04

DRAINAGE AREAS OF POCAHONTAS COUNTY.

The following table gives a list of the principal streams of Pocahontas County with their drainage areas computed by planimeter from the topographic maps:

Areas of Drainage Basins.

STREAMS.	Square Miles.
Greenbrier River (entire)	1629.43
Greenbrier River (in Pocahontas County)	687.06
Spice Run	8.34
Locust Creek	9.98
Trump Run	3.57
Hills Creek	31.60
Bruffey Creek	3.80
Oldham Run	8.01
Nigh Gap Run	2.23
Perry Run	2.09
Laurel Run	13.38
Mill Run	0.80
Rock Run	1.15
Island Lick Run	5.12
Stamping Creek	15.80
Tilda Fork	1.10
Blue Lick Run	1.98

Areas of Drainage Basins (Continued).

STREAMS.	Square Miles.
Stevens Hole Run	3.57
Chicken House Run	2.42
Beaver Creek	16.27
Improvement Lick Run	2.76
Swago Creek	12.92
McClintock Run	1.63
Buck Run	2.04
Dry Creek	3.54
Overholt Run	0.96
Monday Lick Run	2.02
Sunday Lick Run	1.21
Stillhouse Run	2.60
Knapp Creek	109.96
Marlin Run	1.56
Spice Run	0.65
Cummins Creek	11.00
Browns Creek	10.00
Barclay Run	1.18
Laurel Creek	30.68
Douthat Creek	11.65
Cochran Creek	9.72
Rider Run	0.58
Big Sandy Run	1.31
Nicholas Run	0.88
Two Lick Run	0.50
Lost Bottom Run	0.92
Widemouth Run	1.86
Laurel Run	0.70
Lockridge Run	0.74
Ruckman Run	1.67
Guy Run	2.18
Mill Run	2.63
Moore Run	4.85
Sugarcamp Run	6.93
Bird Run	3.60
Price Run	1.01
Stony Creek	22.33
Indian Draft	7.49
Dry Creek	2.20
Pigeon Run	0.88
Halfway Run	1.35
Brush Lick Run	4.73
Sideling Run	2.95
Lewis Lick Run	3.63
Thorny Creek	19.34
Little Thorny Creek	2.72
Laurel Run	3.25
Cloverlick Creek	18.17
Glade Run	2.50
Laurel Run (at Cloverlick)	3.58
Big Run	1.17
Elklick Run	3.33
Woods Run	2.21
Sitlington Creek	51.06
Thomas Creek	8.97

Areas of Drainage Basins (Continued).

STREAMS.	Square Miles.
Moore Run	4.88
Gum Branch	2.10
Shock Run	10.65
Thorny Branch	1.78
Jakes Run	2.79
Stony Run	4.30
Galfred Run	8.65
Left Prong	2.48
Moses Spring Run	1.86
Deer Creek	68.03
North Fork	29.48
Rosen Run	6.50
Cooper Run	1.68
Sutton Run	3.17
Tacker Fork	2.33
Black Run	2.92
Griffin Run	2.53
Elleber Run	2.62
Hospital Run	0.85
Riley Run	2.39
Duncan Run	3.86
Trimble Run	1.70
Buffalo Run	4.27
Saulsbury Run	4.90
Leatherbark Run	6.74
Mill Run	0.76
Deever Run	1.62
Cup Run	0.92
Wanless Run	2.80
Trout Run	2.80
Allegheny Run	3.44
Brush Run	7.40
East Fork, Greenbrier River	69.94
Johns Run	3.30
Little River of East Fork	17.13
Buffalo Fork	6.56
Big Run	2.26
Old House Run	1.42
Reservoir Run (Hollow)	1.36
Rambottom Run	0.85
Gum Cabin Hollow	1.64
Fivemile Hollow	1.94
Poca Run	7.74
Long Run	2.34
Grassy Run	1.26
Lick Run	1.03
Walderman Run	1.43
Bearwallow Run	1.25
Campbell Run	0.64
Mullenax Run	3.45
Abe Run	2.85
Burning Run	2.34
Simmons Run	0.98
Bennett Run	1.28
West Fork, Greenbrier River	62.62

Areas of Drainage Basins (Continued).

STREAMS.	Square Miles.
Mountain Lick Creek	7.58
Fill Run	1.77
Little River of West Fork	19.07
Span Oak Run	2.36
Clubhouse Run	3.00
Elklick Run	1.52
Hinkle Run	3.25
Mill Run	1.38
Gertrude Run	1.32
Elklick Run	2.62
Fox Run	1.75
Mikes Run	1.52
Snorting Lick Run	2.33
Anthony Creek (entire)	146.93
North Fork Anthony Creek	22.77
Dry Run	0.74
Wildcat Run	0.79
Hamilton Lick Run	0.58
Sevenmile Run	0.81
Sugar Hall Run	0.43
Gauley River (entire)	1350.37
Cherry River (entire)	171.90
Cherry River (in Pocahontas County)	5.20
Cranberry River (entire)	74.08
Cranberry River (in Pocahontas County)	41.57
Dogway Fork	9.73
Birchlog Run	1.57
Tumbling Rock Run	2.99
North Fork, Cranberry River	9.83
Hunting Run,	1.02
Cashcamp Run	0.76
Left Fork	1.70
Red Run	1.58
Little Branch	0.81
Charles Creek	3.22
Williams River (entire)	130.63
Williams River (above Middle Fork)	81.53
Middle Fork	27.27
Little Beechy Run	1.33
Beechy Run	5.61
Laurelly Branch	1.52
Hell for Certain Branch	1.36
Coal Run	0.61
County Line Branch	1.47
Bannock Shoals Run	1.03
Hateful Run	0.78
Kins Creek	2.00
Tea Creek	11.50
Lick Creek	1.91
Right Fork	3.90
Sugar Creek	3.86
Little Laurel Creek	4.72
Laurel Creek	8.53
Friel Run	2.51
Galford Run	0.50

Areas of Drainage Basins (Concluded).

STREAMS.	Square Miles.
Day Run	2.96
Black Mountain Run	1.65
Mountain Lick Run	2.25
Beaverdam Run	2.41
Downy Run	1.61
Elk River (above and including Dry Fork at County Line)	75.64
Dry Fork	10.25
Douglas Fork	2.33
Blackhole Run	1.28
Big Run	2.10
Props Run	1.30
Laurel Run	2.87
Big Spring Fork	21.60
Mill Run	1.91
Cup Run	3.14
Old Field Fork	30.69
Slaty Fork	4.85
Mill Creek	2.64
Crooked Fork	5.20
Tygart River (entire)	1435.00
Tygart River (in Pocahontas County)	2.81
Shavers Fork	212.88
Shavers Fork (above Second Fork)	16.96
First Fork	9.97
Second Fork	6.93
Rocky Run	2.76
Black Run	2.06

DESCRIPTION OF DRAINAGE BASINS.

Greenbrier River.—Greenbrier River, the stream that carries the greater part of Pocahontas County's rainfall, has its source in two forks heading in the extreme northern end of the county. West Fork heads east of Shavers Mountain about two miles northeast of Wildell with an elevation of 3,625 feet. East Fork heads at Blister Swamp on the west slope of Allegheny Mountain with an elevation of 3,875 feet and flows in a southwest direction to join the West Fork at Durbin where it makes the Greenbrier River proper. The Greenbrier flows in a comparatively straight line in a southwest direction across Pocahontas and Greenbrier Counties to a point south of Lewisburg where it turns westward to form part of the Greenbrier-Monroe County line. Here it enters Summers County and after much meandering joins New River at Bellepoint, 1½ miles south of Hinton, with an elevation of 1,375 feet.

From the Table of Stream Data on page 34, it can be seen that from its mouth to its East Fork source it has a meandering length of 164.8 miles with an air-line distance of 98.64 miles, or a ratio of 1.67. It has a total fall of 2,500 feet or at the rate of 15.2 feet per mile. From its mouth to its West Fork source it has a meandering length of 162.9 miles with an air-line distance of 97.14 miles or a ratio of 1.67 also. The fall is much more rapid near its source than at the mouth as the following gradient table shows:

Gradient of Greenbrier River.

	Miles.	Elevation.	Fall. Feet.	Rate per Mile. Feet.
Source of East Fork		3875		
Distance	18.8		1175	62.5
Durbin (River forks)		2700		
Source of West Fork		3625		
Distance	16.9		925	54.7
Durbin (River forks)		2700		
Distance	14.9		275	18.4
Cass		2425		
Distance	9.0		155	17.2
Clover Lick		2270		
Distance	16.8		155	9.2
Marlinton		2115		
Distance	21.5		162	7.53
Pocahontas-Greenbrier line		1953		
Distance	22.7		173	7.62
Anthony		1780		
Distance	17.6		135	7.67
Ronceverte		1645		
Distance	15.1		120	7.94
Alderson		1525		
Distance	28.4		150	5.28
Mouth (Bellepoint) (empties into New River 1½ miles south of Hinton)		1375		

According to Reger[10] Greenbrier River has a total drainage area of 1629.43 square miles. In Pocahontas County it has a drainage area of 687.06 square miles. The principal tributaries in Pocahontas are Stamping, Knapp, Laurel, Stony, Thorny, Cloverlick, Sitlington, and Deer Creeks.

[10] David B. Reger, Mercer-Monroe-Summers Report, W. Va. Geol. Sur., p. 96; 1926.

A gaging station was established July 9, 1908, at the Chesapeake and Ohio Railway bridge on the switch that runs to Campbell's lumber mill (now removed) above Marlinton, to obtain data for use in studying water-supply, pollution, water-power, flood control, and storage problems. Careful records were kept until March 31, 1913, and are reliable and accurate. Stony Creek enters immediately above the station. The drainage above this section is approximately 408 square miles.

The records for the years 1908 to 1913 are taken directly from the United States Water-Supply Papers, as follows:

1908, From No. 243, page 82.
1909, From No. 263, page 87.
1910, From No. 283, pages 76-77.
1911, From No. 303, pages 49-50.
1912, From No. 323, pages 54-55.
1913, From No. 353, page 58.

Discharge Measurements of Greenbrier River near Marlinton, W. Va., in 1908.

Date.	Hydrographer.	Width. Feet.	Area of section. Sq. Ft.	Gage height. Feet.	Discharge. Sec.-ft.
July 9..........	O'Neill and Chapman.	217	404	4.01	435
August 3......	W. G. Hoyt...........	181	276	3.59	143

Daily Gage Height, in Feet, of Greenbrier River near Marlinton, W. Va., for 1908.

(Observer, Paris G. Johnston).

Day	July	Aug.	Sept.	Oct.	Nov.	Dec.	Day	July	Aug.	Sept.	Oct.	Nov.	Dec.
1 ...	.....	3.79	3.49	3.24	3.38	3.23	16...	3.56	3.45	3.20	3.20	3.24	3.57
2 ...	.....	3.66	3.44	3.24	3.36	3.23	17....	3.50	3.46	3.26	3.20	3.24	3.73
3 ...	.....	3.58	3.38	3.21	3.36	3.22	18....	3.46	3.42	3.24	3.19	3.23	3.85
4 ...	.....	3.53	3.32	3.21	3.35	3.21	19....	3.56	3.36	3.22	3.19	3.22	3.88
5 ...	.....	3.72	3.29	3.20	3.34	3.21	20....	3.56	3.36	3.20	3.17	3.22	3.87
6 ...	.....	3.84	3.28	3.19	3.33	3.20	21....	3.51	3.38	3.20	3.17	3.21	3.86
7 ...	.....	3.76	3.26	3.18	3.32	3.27	22....	3.51	3.42	3.19	3.16	3.20	3.85
8 ...	.....	3.65	3.24	3.17	3.31	3.36	23....	3.50	3.36	3.18	3.15	3.26	3.85
9 ...	3.99	3.58	3.38	3.23	3.30	3.35	24....	4.06	3.54	3.18	3.23	3.30	3.83
10 ...	3.88	3.53	3.34	3.25	3.30	3.33	25....	4.48	3.56	3.16	3.25	3.30	3.82
11 ...	3.78	3.46	3.30	3.24	3.28	3.39	26....	4.58	3.50	3.15	3.23	3.28	3.80
12 ...	3.68	3.40	3.26	3.23	3.28	3.47	27....	4.71	3.46	3.34	3.23	3.28	3.78
13 ...	3.62	3.33	3.24	3.22	3.26	3.47	28....	4.72	3.40	3.32	3.21	3.25	3.78
14 ...	3.58	3.42	3.23	3.21	3.26	3.45	29....	4.34	3.36	3.29	3.29	3.25	3.76
15 ...	3.60	3.46	3.22	3.21	3.25	3.50	30....	4.12	3.55	3.26	3.39	3.24	3.80
							31....	3.92	3.54	.....	3.38	.....	3.86

Discharge Measurements of Greenbrier River near Marlinton, W. Va., in 1909.

Date.	Hydrographer.	Width. Feet.	Area of section. Sq. Ft.	Gage height. Feet.	Dis-charge. Sec.-ft.
April 17.......	H. J. Jackson	230	618	5.02	1,300
April 19.......	H. J. Jackson	228	516	4.54	788
November 18 ..	A. H. Horton.........	175	294	3.73	291
December 2....	G. L. Parker..........	168	261	3.55	136

Daily Gage Height, in Feet, of Greenbrier River near Marlinton, W. Va., for 1909.

(Paris G. Johnston, Observer).

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1 ...	3.92	3.36	4.64	4.46	5.18	3.91	4.52	4.74	3.34	3.27	3.49	3.58
2 ...	3.98	3.31	4.51	4.79	5.04	3.90	4.35	4.29	3.32	3.26	3.47	3.62
3 ...	4.12	3.27	4.37	4.71	4.90	4.00	4.16	4.00	3.28	3.25	3.47	3.62
4 ...	4.62	3.21	4.72	4.63	4.73	4.06	3.82	3.82	3.26	3.23	3.42	3.61
5 ...	5.68	3.15	4.66	4.59	4.56	4.33	3.63	3.68	3.36	3.23	3.37	3.60
6 ...	5.44	3.10	4.60	4.63	4.44	4.24	3.72	3.59	3.48	3.21	3.42	3.58
7 ...	5.02	3.07	4.54	4.67	4.32	4.10	3.77	3.55	3.40	3.21	3.39	3.57
8 ...	.4.69	3.89	4.47	4.40	4.21	4.02	3.70	3.52	3.33	3.20	3.40	3.56
9 ...	4.38	6.20	4.50	4.54	4.14	4.10	3.60	3.49	3.32	3.19	3.95	3.55
10 ...	4.28	6.29	4.92	4.37	4.92	4.05	3.51	3.45	3.35	3.18	4.89	3.53
11 ...	4.26	6.14	5.47	4.19	4.97	3.98	3.46	3.42	3.33	3.59	4.72	3.49
12 ...	4.22	5.95	5.70	4.13	4.78	3.87	3.46	3.39	3.33	4.53	4.38	3.45
13 ...	4.24	5.68	6.07	5.71	4.62	3.81	3.56	3.36	3.36	4.09	4.22	4.93
14 ...	4.59	5.56	5.86	8.27	4.44	3.78	3.54	3.34	3.32	3.85	4.11	6.79
15 ...	5.66	5.81	5.50	6.53	4.28	3.87	3.55	3.43	3.28	3.75	3.87	5.34
16 ...	5.90	6.41	5.15	5.49	4.17	4.33	3.50	3.98	3.29	3.69	3.77	4.39
17 ...	5.83	6.55	4.80	4.99	4.08	4.10	3.44	3.98	3.37	3.65	3.75	4.40
18 ...	5.74	6.38	4.55	4.74	3.97	4.58	3.38	3.76	3.35	3.63	3.73	4.30
19 ...	5.66	6.05	4.43	4.54	3.88	4.50	3.40	3.66	3.33	3.60	3.67	4.21
20 ...	5.58	5.71	4.29	4.36	3.88	4.28	3.36	3.60	3.31	3.56	3.62	4.11
21 ...	5.50	5.54	4.15	4.63	4.45	4.12	3.34	3.56	3.31	3.53	3.62	4.00
22 ...	5.40	5.44	4.04	5.22	5.78	3.94	3.33	3.53	3.29	3.52	3.63	3.94
23 ...	5.27	5.32	3.91	6.12	5.14	3.89	3.34	3.49	3.28	3.51	3.65	3.89
24 ...	5.19	5.22	3.81	6.14	4.70	3.88	3.32	3.45	3.27	3.87	3.78	3.82
25 ...	5.09	5.10	3.70	5.50	4.46	3.78	3.29	3.40	3.27	3.92	3.78	3.75
26 ...	5.00	4.98	3.61	5.10	4.52	3.72	3.38	3.38	3.25	3.77	3.70	.....
27 ...	4.91	4.86	3.49	4.86	4.56	3.70	3.40	3.36	3.29	3.72	3.67	.....
28 ...	4.83	4.78	5.86	4.67	4.34	3.67	3.38	3.34	3.32	3.66	3.65	.....
29 ...	4.69	.....	6.29	4.91	4.18	3.66	3.32	3.31	3.29	3.60	3.62	.....
30 ...	4.50	.....	6.04	5.38	4.06	4.18	3.50	3.38	3.27	3.53	3.59	.....
31 ...	3.41	.....	4.77	.....	3.96	.....	5.36	3.36	.....	3.51	.....	3.89

NOTE—Ice conditions December 22 to 31. December 31, thickness of ice 0.2 foot.

Discharge Measurements of Greenbrier River near Marlinton, W. Va., in 1910.

Date.	Hydrographer.	Width. Feet.	Area of section. Sq. Ft.	Gage height. Feet.	Discharge. Sec.-ft.
August 22......	J. C. Dort..............	183	318	3.88	264
October 10.....	C. T. Bailey..........	183	319	3.77	233

Daily Gage Height, in Feet, of Greenbrier River near Marlinton, W. Va., for 1910.

(Paris G. Johnston, Observer).

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1 ...	(a)	4.12	7.25	3.76	4.44	4.02	3.83	3.44	3.68	3.59	3.38	3.84
2 ...	.....	4.10	6.32	3.76	4.26	4.02	3.79	3.42	4.12	3.49	3.44	3.96
3 ...	.....	4.09	5.15	3.74	4.12	4.06	3.83	3.40	3.96	3.37	3.46	3.86
4 ...	.....	4.07	5.35	3.76	4.06	4.08	3.86	3.36	4.22	3.30	3.42	(b)
5 ...	.....	4.05	5.05	3.81	3.98	5.48	3.90	3.44	4.65	3.34	3.40	.....
6 ...	.....	4.05	5.00	3.82	3.85	6.15	3.96	3.41	4.50	3.40	3.38	.....
7 ...	.....	4.04	4.95	3.80	3.82	5.81	3.99	3.38	4.18	3.36	3.36	.....
8 ...	.....	4.04	4.79	3.80	3.88	5.19	4.04	3.37	3.86	3.48	3.35	.....
9 ...	4.71	4.12	4.49	3.76	3.92	4.38	4.01	3.36	3.73	3.86	3.34	.....
10 ...	4.59	4.10	4.40	3.72	3.90	4.92	3.98	3.35	3.67	3.79	3.34	.....
11 ...	4.30	4.10	4.45	3.70	3.86	6.26	3.92	3.36	3.60	3.71	3.32	.....
12 ...	4.25	4.09	4.40	3.74	3.84	6.48	3.86	3.42	3.52	3.62	3.31	.....
13 ...	4.20	4.08	4.36	4.10	4.12	6.79	3.81	3.54	3.51	3.52	3.30	.....
14 ...	4.05	4.15	4.34	4.21	4.64	6.80	3.91	3.48	3.60	3.46	3.30	.....
15 ...	4.04	4.19	4.31	4.12	4.58	6.15	4.16	3.44	3.56	3.42	3.28	.....
16 ...	4.02	4.30	4.28	4.05	4.38	10.30	4.38	3.38	3.50	3.38	3.28	.....
17 ...	4.00	6.00	4.21	4.10	4.25	8.62	4.54	3.38	3.46	3.38	3.27	3.85
18 ...	4.12	7.89	4.13	4.24	4.17	6.39	4.42	3.48	3.40	3.36	3.26	.....
19 ...	5.55	5.72	4.00	4.38	4.10	5.78	4.30	3.46	3.41	3.35	3.26	.....
20 ...	4.95	5.40	3.96	4.46	4.08	5.46	4.18	3.42	3.42	3.34	3.24	.....
21 ...	6.24	5.19	3.92	4.48	4.30	5.24	4.04	3.45	3.36	3.32	3.24	.....
22 ...	6.34	5.50	3.91	4.45	4.30	5.04	3.92	3.86	3.34	3.32	3.23	.....
23 ...	5.52	5.58	3.90	4.44	4.24	4.86	3.86	3.74	3.32	3.30	3.25	.....
24 ...	4.84	5.10	3.90	4.65	4.19	4.70	3.82	3.55	3.30	3.42	3.77	.....
25 ...	4.53	4.75	3.90	4.80	4.38	4.47	3.73	3.46	3.58	3.46	3.92	.....
26 ...	4.30	4.50	3.90	4.78	4.36	4.29	3.64	3.41	3.90	3.39	3.82	.....
27 ...	4.34	4.26	3.88	4.76	4.24	4.16	3.58	3.37	4.04	3.34	3.74	.....
28 ...	4.29	5.17	3.86	4.85	4.15	4.05	3.56	3.34	3.90	3.32	3.59	.....
29 ...	4.20	.....	3.84	4.75	4.14	3.96	3.53	3.32	3.78	3.46	3.78	.....
30 ...	4.17	.....	3.82	4.61	4.08	3.88	3.50	3.30	3.68	3.46	3.93	.....
31 ...	4.15	.....	3.80	.....	4.06	.....	3.46	3.32	.....	3.42	.....	.....

(a) Jan. 1 to 8, gage not read because of illness of observer.
(b) Dec. 4 to 31, gage record lost by observer.
NOTE.—Relation of gage height to discharge affected by ice about Dec. 10 to 26.

On page 59 of Water-Supply Paper 303, the following data are given:

"Point of zero flow.—A determination by leveling August 22, 1910, indicates that there would be no flow past the gage if the river stage were to fall to 2.25 feet∓0.2 foot.

"Winter flow.—Relation of gage height to discharge may be affected by ice for short periods during December, January, and February.

"The following discharge measurement was made by Bailey and Perwien:

"November 3, 1911: Gage height, 3.75 feet; discharge, 210 second-feet."

Daily Gage Height, in Feet, of Greenbrier River near Marlinton, W. Va., for 1911.

(Paris G. Johnston, Observer).

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1 ...	5.28	6.98	4.31	4.78	4.24	4.20	3.50	3.20	4.92	4.70	3.82	.....
2 ...	6.76	6.39	4.39	4.65	4.16	3.92	3.46	3.19	4.45	4.66	3.73	.....
3 ...	9.07	5.81	4.32	4.50	4.10	3.68	3.43	3.24	4.11	4.64	3.64	.....
4 ...	7.91	5.30	4.22	6.06	4.04	3.57	3.39	3.24	3.82	4.60	3.51	.....
5 ...	6.40	4.97	4.14	7.63	3.97	3.82	3.36	3.38	3.66	4.55	3.46	.....
6 ...	5.52	4.83	4.06	7.02	3.92	4.23	3.68	3.47	3.56	4.50	3.80	.....
7 ...	4.88	4.72	4.36	5.96	3.88	4.16	3.98	3.42	3.50	4.84	5.08	.....
8 ...	4.55	4.62	4.78	5.50	3.85	4.72	3.94	3.34	3.44	5.24	5.17	.....
9 ...	4.34	4.57	4.76	5.22	3.81	4.33	3.91	3.30	3.37	5.33	4.97	.....
10 ...	4.20	4.66	5.55	4.98	3.78	4.10	3.88	3.26	3.43	5.18	4.76	.....
11 ...	5.68	4.60	5.86	4.80	3.72	3.97	3.83	3.24	3.42	5.02	4.62	.....
12 ...	6.90	4.51	5.72	4.64	3.66	4.05	3.73	3.23	3.38	4.88	.....	.....
13 ...	7.36	4.44	5.66	5.30	3.60	4.10	3.61	3.22	3.33	4.60	.....	.....
14 ...	6.90	4.36	5.60	6.58	3.58	3.97	3.51	3.21	3.26	4.34	.....	.....
15 ...	5.96	4.29	5.54	6.47	3.57	3.81	3.44	3.20	3.62	4.36	.....	.....
16 ...	5.58	4.22	5.64	6.18	3.56	3.72	3.36	3.20	5.76	5.04	.....	.....
17 ...	5.20	4.15	5.76	5.96	3.56	3.63	3.37	3.19	5.72	5.95	.....	5.60
18 ...	4.88	4.10	5.92	5.79	3.54	3.60	3.38	3.18	5.63	8.14	.....	5.78
19 ...	4.60	4.04	6.12	5.57	3.53	3.86	3.38	3.17	5.54	6.88	4.83	6.20
20 ...	4.37	3.95	6.04	5.36	3.52	3.76	3.37	3.17	5.42	5.64	4.76	5.97
21 ...	4.32	4.00	5.64	5.18	3.50	3.86	3.37	3.16	5.30	5.21	4.70	5.76
22 ...	5.42	4.28	5.22	5.04	3.48	3.82	3.36	3.16	5.18	5.03	4.60	5.67
23 ...	5.96	4.46	5.06	4.94	3.48	3.76	3.35	3.15	5.06	4.86	4.49	5.93
24 ...	5.86	4.42	4.94	4.85	3.47	3.73	3.34	3.15	4.94	4.66	4.41	5.78
25 ...	5.60	4.36	4.81	4.74	3.46	3.69	3.36	3.14	4.83	4.48	4.34	5.61
26 ...	5.72	4.32	4.76	4.62	3.58	3.66	3.35	3.14	4.76	4.38	.....	5.44
27 ...	6.66	4.23	5.21	4.50	4.50	3.64	3.32	3.26	4.69	4.27	.....	5.28
28 ...	6.91	4.16	5.42	4.44	4.52	3.60	3.28	3.98	4.64	4.17	.....	5.13
29 ...	6.46	.....	5.20	4.39	4.90	3.55	3.25	4.92	4.58	4.08	.....	5.30
30 ...	11.62	.....	5.07	4.31	4.67	3.52	3.22	5.42	4.53	4.00	.....	5.70
31 ...	9.10	.....	4.93	.....	4.44	.....	3.20	5.43	.....	3.91	.....	6.67

NOTE.—Observer made no report concerning ice. Relation of gage height to discharge probably not affected by ice during 1911.

Discharge Measurements of Greenbrier River at Marlinton, W. Va., in 1912.

Date.	Hydrographer.	Gage height. Feet.	Discharge. Sec.-Ft.
March 23......	C. T. Bailey...............	5.44	1,790
March 25......	C. T. Bailey...............	6.84	4,090
September 6...	C. T. Bailey...............	3.27	(a) 35.1

(a) Measurement made by wading.

"Point of zero flow.—A determination by leveling September 6, 1912, indicates that there would be no flow past the gage if the river stage were to fall to 2.7 feet ± 0.1 foot."

Daily Gage Height, in Feet, of Greenbrier River near Marlinton, W. Va., for 1912.

(Paris G. Johnston, Jan. 1-Aug. 17, and A. N. Rudd, Sept. 6-Dec. 31, Observers).

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1 ...	6.3	.....	4.85	5.8	4.21	3.52	4.40	4.26	.....	3.78	3.48	3.62
2 ...	5.8	.....	4.75	5.5	4.16	3.48	4.33	4.02	.....	3.62	3.45	3.56
3 ...	5.35	.....	4.65	5.25	4.12	3.46	4.28	3.82	.....	3.64	3.45	3.64
4 ...	4.9	3.03	4.55	5.1	4.07	3.44	4.24	3.72	.....	3.50	3.42	3.88
5 ...	4.5	.....	4.5	4.8	4.02	3.42	4.18	3.66	.....	3.49	3.40	4.02
6 ...	4.16	.....	4.44	4.5	3.96	3.42	4.13	3.59	3.31	3.45	3.40	4.7
7 ...	4.12	.....	4.37	4.28	3.91	3.40	4.05	3.56	3.31	3.40	5.45	4.8
8 ...	4.25	.....	4.30	4.44	3.88	3.39	3.96	3.52	3.31	3.44	5.9	4.5
9 ...	4.32	.....	4.26	4.7	3.86	3.38	3.89	3.60	3.30	3.42	5.1	4.25
10 ...	4.37	.....	4.21	4.6	3.83	3.35	3.83	3.60	3.30	3.40	4.6	4.18
11 ...	4.42	2.97	4.16	4.48	4.55	3.32	3.79	2.55	3.29	3.40	4.36	4.15
12 ...	4.40	.....	4.23	4.32	6.5	3.28	3.74	3.49	3.25	3.40	4.15	4.08
13 ...	4.38	.....	4.55	4.22	8.7	3.26	3.68	3.46	3.24	3.40	4.00	4.03
14 ...	4.34	.....	5.0	4.14	6.7	3.22	3.62	3.44	3.25	3.40	3.95	4.00
15 ...	4.30	.....	8.7	4.08	5.6	3.19	3.56	3.42	3.25	3.38	3.90	4.10
16 ...	4.30	.....	8.6	4.6	7.5	3.29	3.52	3.42	3.26	3.38	3.82	4.10
17 ...	4.28	.....	7.0	5.1	7.0	3.59	3.46	3.41	3.26	3.36	3.70	3.92
18 ...	4.26	2.85	6.1	5.35	6.0	4.01	3.40	.....	3.32	3.38	3.70	3.92
19 ...	4.26	.....	4.8	5.4	5.5	4.08	3.33	.....	3.39	3.38	3.63	3.85
20 ...	4.24	.....	5.45	5.05	5.3	4.00	3.27	.....	3.38	3.45	.....	3.85
21 ...	4.24	7.0	6.0	4.9	5.0	3.90	3.24	.....	3.40	3.48	3.62	3.85
22 ...	4.42	6.5	5.4	4.8	5.6	3.83	3.22	.....	3.36	3.48	3.61	3.80
23 ...	4.75	6.2	4.9	4.7	5.15	3.76	3.18	.....	3.82	3.50	3.60	3.65
24 ...	4.8	5.8	5.8	4.6	4.7	3.70	3.63	.....	4.9	3.60	3.56	.....
25 ...	4.75	5.6	6.3	4.55	4.35	3.58	7.2	.....	4.7	3.70	3.53	3.8a
26 ...	4.7	5.4	5.9	4.46	4.07	3.48	7.6	.....	4.08	3.68	3.50	.....
27 ...	4.6	5.2	5.5	4.39	3.88	3.63	6.4	.....	4.00	3.62	3.50	.....
28 ...	.....	5.1	5.1	4.34	3.74	3.88	5.7	.....	3.85	3.60	3.58	.....
29 ...	.....	4.95	7.2	4.30	3.66	4.49	5.1	.....	3.78	3.55	3.50	.....
30 ...	.....	.....	6.9	4.26	3.60	4.75	4.8	.....	3.82	3.52	3.50	3.80
31 ...	3.12	.....	6.2	.....	3.56	.....	4.5	.....	.....	3.50	.....	6.3

(a) Gage height to top of ice.

NOTE.—Relation of gage height to discharge probably affected by ice about Jan. 7 to Feb. 21 and during most of the period from Nov. 27 to Dec. 30. Observer made no report concerning ice prior to Jan. 28, but from then to Feb. 18 river was reported partly frozen, with ice from 5 to 10 inches thick and broken up at the control. On Feb. 21 rain and the ice break-up were reported. On Nov. 28, Dec. 1 and 2, observer reported river frozen over. On Dec. 4-6, general rain; Dec. 12, ice running; Dec. 13, river frozen over; Dec. 14, "ice gorges up sometimes"; Dec. 25, ice heavy, with snow on top of it; Dec. 30-31, general rain on heavy snow—rain caused rise.

Daily Gage Height, in Feet, of Greenbrier River near Marlinton, for the Year Ending September 30, 1913.

(A. N. Rudd, U. G. Simpson, and C. H. McCoy, Observers).

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1 ...	3.78	3.48	3.62	5.4	5.0	4.95	4.95	4.32	5.2	3.68	3.76	3.22
2 ...	3.62	3.45	3.56	4.7	.....	4.8	4.75	4.27	4.95	3.60	3.88	3.33
3 ...	3.64	3.45	3.64	5.3	.....	4.45	4.6	4.25	4.9	3.50	3.70	3.28
4 ...	3.50	3.42	3.88	5.6	5.8	4.5	4.5	4.22	4.9	3.66	3.60	3.40
5 ...	3.49	3.40	4.02	5.2	5.5	4.35	4.42	4.00	4.9	3.83	3.53	3.10
6 ...	3.45	3.40	4.7	5.1	5.1	4.28	4.35	3.92	4.6	3.89	3.42	3.36
7 ...	3.40	5.45	4.8	7.6	4.65	4.12	4.28	3.98	4.36	3.80	3.37	3.26
8 ...	3.44	5.9	4.5	7.9	4.42	3.95	4.20	4.05	4.45	3.74	3.32	3.36
9 ...	3.42	5.1	4.25	7.2	4.38	4.08	4.20	3.96	4.40	3.68	3.28	3.38
10 ...	3.40	4.6	4.18	5.9	4.28	4.12	4.15	3.84	4.37	8.9	3.28	3.36
11 ...	3.40	4.26	4.15	5.35	4.28	5.3	4.15	3.78	4.15	8.1	3.36	3.33
12 ...	3.40	4.15	4.08	5.15	4.32	5.3	5.9	3.73	4.04	6.5	3.63	3.27
13 ...	3.40	4.00	4.03	5.5	4.25	5.1	7.7	3.64	3.98	4.8	5.6	3.23
14 ...	3.40	3.95	4.00	5.2	4.35	7.5	6.3	3.68	3.87	4.44	5.4	3.18
15 ...	3.38	3.90	4.10	4.9	4.25	7.0	7.9	3.68	3.82	4.32	4.23	3.17
16 ...	3.38	3.82	4.10	4.65	4.15	6.3	7.3	3.78	3.76	4.27	3.78	3.13
17 ...	3.36	3.70	3.92	4.55	4.00	5.5	6.2	3.82	3.70	4.23	3.62	3.18
18 ...	3.38	3.70	3.92	4.45	3.90	5.0	5.6	4.31	3.68	4.14	3.78	3.30
19 ...	3.38	3.63	3.85	4.35	3.90	4.8	5.15	4.8	3.64	4.18	4.15	3.58
20 ...	3.45	.....	3.85	4.30	3.90	4.65	5.0	4.7	3.63	4.26	3.93	3.86
21 ...	3.48	3.62	3.85	4.22	3.98	4.5	4.85	4.8	3.62	4.03	3.80	4.03
22 ...	3.48	3.61	3.80	4.20	4.22	4.40	4.6	4.7	3.62	3.86	3.80	4.09
23 ...	3.50	3.60	3.65	4.20	4.48	4.22	4.5	5.05	3.68	3.80	4.40	3.96
24 ...	3.60	3.56	.....	4.48	4.32	4.20	4.5	7.1	3.72	3.84	4.46	3.87
25 ...	3.70	3.53	3.8 (a)	5.0	4.22	4.18	4.42	6.6	3.76	3.82	4.33	3.80
26 ...	3.68	3.50	.....	4.9	4.15	4.30	4.32	6.4	3.92	3.74	4.18	3.66
27 ...	3.62	3.50	.....	4.9	4.30	11.8	4.35	7.4	4.10	3.72	3.98	3.50
28 ...	3.60	3.58	.....	4.9	5.0	8.1	4.40	7.6	4.00	3.66	3.78	3.42
29 ...	3.55	3.50	.....	4.75	.....	6.2	4.5	7.1	3.90	3.55	3.62	3.37
30 ...	3.52	3.50	3.80	4.5	.....	5.5	4.38	6.2	3.86	3.48	3.46	3.34
31 ...	3.50	.....	6.3	.....	.....	5.2	.....	5.4	.....	3.53	3.26	.....

(a) Gage height to top of ice.

NOTE.—Discharge relation probably affected by ice during most of December, 1912, and from Feb. 6-16, 1913. On Dec. 1 and 2 observer reported river frozen over; Dev. 4-6, general rain; Dec. 12, ice running; Dec. 13, river frozen over; Dec. 14, "ice gorges up sometimes"; Dec. 25, ice heavy, with snow on top of it; Dec. 30-31, cause of rise, general rain on heavy snow; Feb. 4-9, freezing weather; Feb. 13, ice flowing.

Spice Run.—Spice Run has its source in several smaller branehes high up on Beaver Liek Mountain and flows in a general westward direetion to form the Greenbrier-Pocahontas boundary for some five miles to where it joins the Greenbrier River. It has a meandering length of 6.1 miles with a total fall of 1,000 feet or at the rate of 163.9 feet per mile. It has a drainage area of 8.34 square miles.

Locust Creek.—Loeust Creek has its source in a spring against the east side of Droop Mountain and flows south for a distance of 3½ miles where it is joined by a small tributary

PLATE VII.—View of Cloverlick Mountain southwest from Thorny Flat. The even crest line is formed by the Mauch Chunk sandstones with a northwest dip. (Photo. by Paul H. Price).

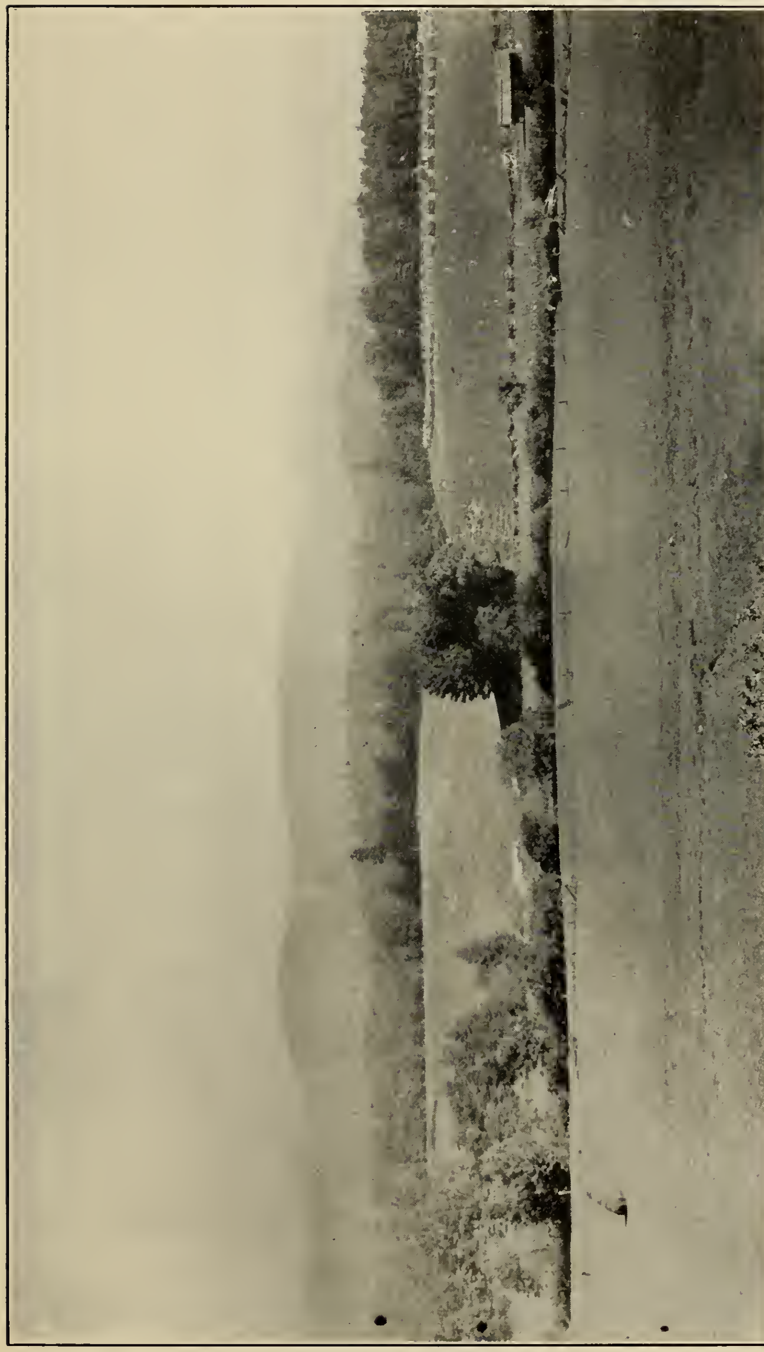

PLATE VIII.—Stream Terraces along Shock Run near the Greenbank-Huntersville District line. (Photo. by Paul H. Price).

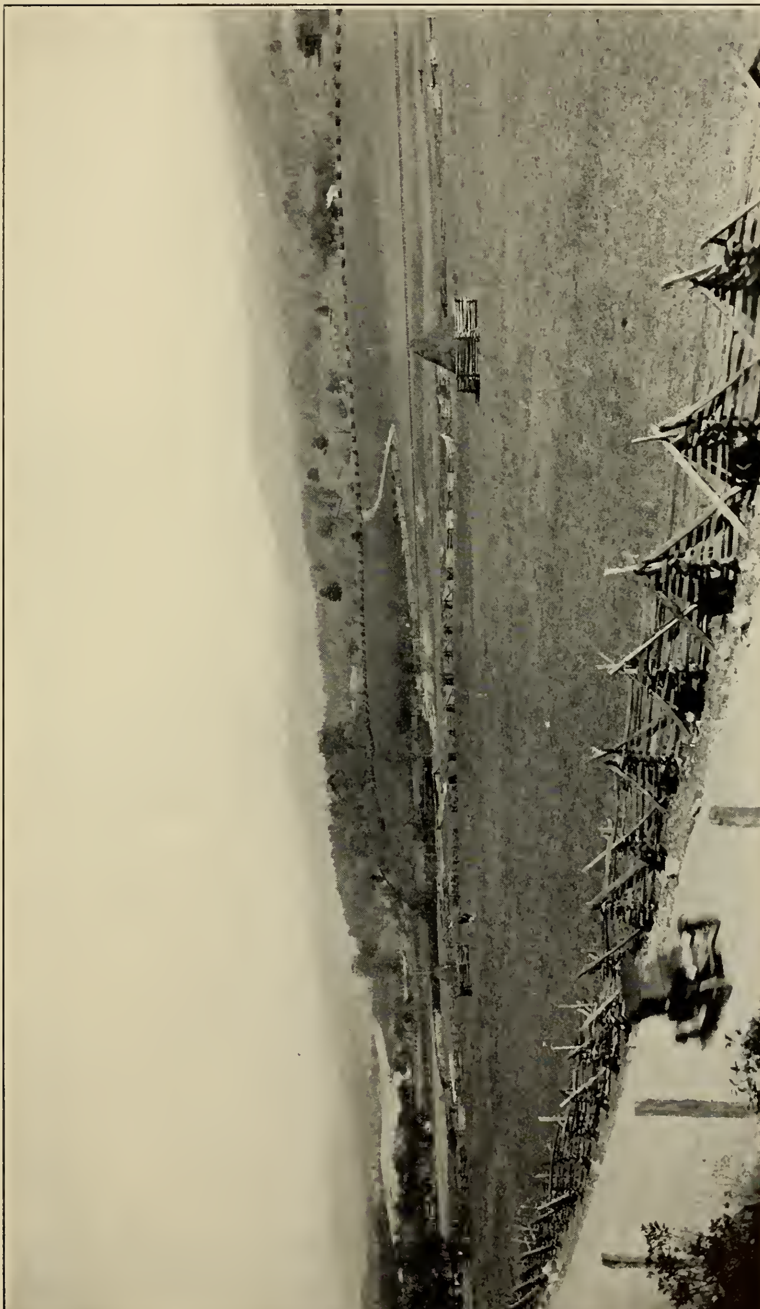

PLATE IX.—Terrace along Shock Run, a tributary to Sitlington Creek east of Mt. Hope Church near Huntersville-Greenbank District line. (Photo. by Paul H. Price).

PLATE X.—A long narrow terrace between Sitlington Creek and Thorny Branch. The top is composed of stream sand and rounded boulders. (Photo. by Paul H. Price).

in Trump Run and continues east to the Greenbrier River at Locust Station. It is a short run with a considerable volume of water with a slight fall. This run is a continuation of Hills Creek which sinks beneath Droop Mountain on the opposite side. It was reported that coloring matter had been placed in Hills Creek and found to emerge at the head of Locust Creek. This report was not verified in the field but is undoubtedly the truth. Locust Creek has a drainage area of 9.98 square miles.

Hills Creek.—Hills Creek heads high up on Kennison Mountain of Yew Mountains and flows west for some three miles where it is joined by a small branch and turns south to form a series of beautiful falls in "Falls of Hills Creek". See Plate XXII. It continues southeast, being joined by smaller branches, to a point 1½ miles southeast of Lobelia where it sinks into the Greenbrier Limestone beneath Droop Mountain (See description of Locust Creek). It has a total length of 8.4 miles with an air-line distance of 5 miles or a ratio of 1.68, and its drainage area is 31.6 square miles.

Bruffey Creek.—Bruffey Creek is a small stream with its source west of Viney Mountain and flows south where it is joined by Cave Run and sinks beneath the surface one mile southeast of Lobelia.

Oldham Run.—Oldham Run rises west of Burr Valley and flows in a westward direction, south of Pond Ridge, and is joined by Perry and Nigh Gap Runs, and enters the Greenbrier River one-half mile due east of Locust Station.

Laurel Run.—Laurel Run heads high up on Beaver Lick Mountain northeast of Burr Post-Office and with several unnamed tributaries forms the drainage of Burr Valley. It then continues west to a point one-half mile north of Denmar where it empties into the Greenbrier River. It has a total length of 8.2 miles with a fall of 1,220 feet or at the rate of 148.7 feet per mile. It has a drainage area of 13.38 square miles.

Mill Run.—Mill Run is a small stream which heads high up against an unnamed ridge southeast of Kennison and flows northwest, entering the river at the latter point.

Rock Run.—Rock Run is another small branch with a single tributary emptying into Greenbrier River from the east one mile above Kennison.

Island Lick Run.—Island Lick Run empties into the river from the east midway between Kennison and Seebert, having its source high up on the west side of Pyle Mountain. It has a drainage area of 5.12 square miles.

Stamping Creek.—Stamping Creek has its source in three small branches high up on the east side of Cranberry Mountain. Its tributaries are Blue Lick Run, Tilda Fork, and other unnamed branches. It flows in a southeastward direction, occasionally sinking beneath the limestone but rising again near Mill Point where it is used intermittently to turn overshot wheels to grind feed and flour and to propel a small turbine generator. It enters Greenbrier River one-half mile north of Seebert. It has a meandering length of 6.8 miles with a total fall of 1,710 feet or at the rate of 251.5 feet per mile. Its drainage area is 15.8 square miles.

Stevens Hole Run.—Stevens Hole Run is a small stream of little importance but of considerable local interest. It has its source in a limestone spring just west of the State highway 0.7 mile northeast of Mill Point and flows in a southward direction to the Greenbrier River one mile northeast of Seebert. It has a total length of 2½ miles with a drainage area of 3.57 square miles.

Chicken House Run.—Chicken House Run is another minor tributary of the Greenbrier River joining the latter stream one-half mile south of Watoga. It heads on the west slope of Pyle Mountain and flows almost due west for a distance of 2.8 miles. Its drainage area is 2.42 square miles.

Beaver Creek.—Beaver Creek is made up of two branches with several smaller tributaries roughly forming a **Y**, the southern branch heading well up on the west side of Beaver Lick Mountain with the northern branch heading on the east side of Buckley Mountain, and the two uniting to cut a pass between Pyle and Buckley Mountains to join the Greenbrier River at Violet. The old county road from Hillsboro to Huntersville followed along this stream when the latter town was the county-seat. Beaver Creek has a drainage area of 16.27 square miles.

Improvement Lick Run.—This is a small stream with a length of 3.6 miles, having its source near the top of Buckley Mountain and flowing westward to join Greenbrier River one mile northeast of Violet.

Swago Creek.—Swago Creek is a stream with a considerable volume of water originating largely from springs that emerge from the Greenbrier and Mauch Chunk Series. It is composed of the following tributaries: McClintock Run, Overholt Run, Dry Creek, and Buck Run. This network of streams has cut a prominent cove between the ranges of Rodgers Mountain, Swago Mountain, and Spruce Flats. Swago Creek enters the Greenbrier River at Buckeye, and has a drainage area of 12.92 square miles.

Monday Lick and Sunday Lick Runs.—These two small streams head near the top of Buckley Mountain and flow in a westward direction to join the Greenbrier River about 800 feet apart one mile south of Stillwell.

Stillhouse Run.—Another run of small importance heading near the north end of Buckley Mountain is Stillhouse Run. It is the first stream south of Knapp Creek and enters the Greenbrier River at Stillwell. Its total length is 3.1 miles with a drainage area of 2.6 square miles.

Knapp Creek.—Knapp Creek is the Greenbrier River's largest and most important tributary in Pocahontas County. It has its source close the State line near the top of Allegheny Mountain five miles northeast of Frost. It flows in a southwest direction across the Upper Devonian sandstones and shales to Frost where it is forced to swing to the south because of the Browns-Michael Mountain uplift. From this point it follows the less resistant Middle Devonian shales to Minnehaha Springs where it is joined by Laurel Creek and its tributaries from an opposite direction and swings northwest to cut a deep gorge through these ranges to join the Greenbrier River at Marlinton. It has a total length of 26.8 miles with an air-line distance of 17.76 miles, or a ratio of 1.51. It has a total fall of 1,560 feet or at the rate of 58.2 feet per mile, with a drainage area of 109.96 square miles.

Marlin Run.—This is a small run of minor importance heading near the top of Marlin Mountain and flowing due west for a distance of 2.7 miles, through the town of Marlinton to join Knapp Creek one-half mile above its mouth. It has a total fall of 630 feet with a drainage area of 1.56 square miles.

Spice Run.—(See table of stream data).

Cummins Creek.—Cummins Creek heads between two Medina folds near the top of Brushy Mountain. It flows practically due north for a distance of 6 miles to join Knapp Creek near Huntersville. It has a drainage area of 11 square miles.

Browns Creek.—Browns Creek has its source in several smaller branches in the vicinity of "The Horse Ridge" on Browns Mountain. Near the head of this stream is a fine large spring emanating from near the contact of the Helderberg-Bossardville limestones on the farm of Peter McCarty (See springs under Mineral Waters). This stream flows southwest along the Middle Devonian shales for a distance of 3½ miles to join Knapp Creek near Huntersville. It has a drainage area of 10 square miles.

Barclay Run.—(See table of stream data).

Laurel Creek.—Laurel Creek with branches in Camp Hollow, Douthat Creek, Cochran Creek, Lockridge Run, and many smaller branches, is Knapp Creek's largest tributary from the standpoint of volume. Laurel Creek has its source on Allegheny Mountain only 3.6 miles (air-line distance) from its mouth but flows in a southerly direction to Rimel where it is joined by Cochran Creek, with its numerous tributaries from the south. Thence it flows northwest, cutting a gorge across the north end of Middle Mountain and is joined by Douthat Creek, also from the south, one mile south of Minnehaha Springs, where it enters Knapp Creek. It has a total drainage area of 30.68 square miles.

Ruckman, Guy, and Mill Runs.—These are small tributaries of Knapp Creek from Browns Mountain on the west. (See table of stream data).

Moore Run.—Moore Run, with small feeders in McLaughlin and Sharp Hollows, is a minor stream from a source near the top of Allegheny Mountain which empties into Knapp Creek two miles southwest of Frost.

Sugarcamp and Bird Runs.—(See table of stream data).

Price Run.—Price Run has its source in a large limestone spring emanating from the east side of Stony Creek Mountain and west of Jericho Flat and Marlinton. No figures are available as to the volume of this spring but as pointed out by Dr. James Price of Marlinton it would be sufficient to form a beautiful artificial lake if piped to a natural depression on Jericho Flat. This run has a meandering length of 1.1 miles with a total fall of 285 feet or at the rate of 259 feet per mile. It has a surface drainage area of 1.01 square miles.

Stony Creek.—Stony Creek empties into the Greenbrier River 1.1 miles north of the river bridge at Marlinton. It has its source 0.8 mile due west of Woodrow and is joined by several tributaries of lesser importance in Sharp Run, Pigeon Run, Dry Creek, Indian Draft, and other smaller unnamed branches, a large part of the water coming from the several large limestone springs (McLaughlin) along Dry Creek east of Onoto. Stony Creek has a total length of 6.6 miles with a fall of 1,300 feet or at the rate of 196.9 feet per mile. With its tributaries it has a drainage area of 22.33 square miles. A part of the water of Stony Creek is used to propel a turbine for the Geiger Mill.

Halfway Run.—This is a small stream of minor importance heading near the top of Marlin Mountain and flowing in practically a straight gorge northwest to the Greenbrier River at Knapp. It has a total length of 2.2 miles with a drainage area of 1.35 square miles.

Brush Lick Run.—Brush Lick Run heads 0.8 mile southeast of Warwick. It is joined by Sideling Run, a stream of greater length, 0.6 mile east of August where the parent stream empties into the Greenbrier River. It has a drainage area of 4.73 square miles.

Lewis Lick Run.—Lewis Lick Run has its source in three forks high up on the south side of Gay Knob and flows south for a distance of 4.6 miles where it joins the Greenbrier River at August. It has a total fall of 1,105 feet or at the rate of 240.2 feet per mile and a drainage area of 3.63 square miles.

Thorny Creek.—Thorny Creek, with many small tributaries, heads high up on the southern end of Michael Mountain. It is joined from the west by Little Thorny Creek and flows southwest to a point 0.8 mile southwest of Dilleys Mill where it flows west for a distance of $1\frac{1}{4}$ miles, cutting a deep gorge between Thorny Creek and Marlin Mountains, thence in a well-entrenched meander in a southwest direction to Greenbrier River one-half mile northeast of August. Thorny Creek has a total length of 9.6 miles with a drainage area of 19.34 square miles.

Laurel Run.—(Edray District; See table of stream data).

Cloverlick Creek.—This stream has its source in two forks heading between Gay Knob and Cloverlick Mountain, the two uniting to flow north for some four miles where it swings to the east forming a semicircle around the northern end of Cloverlick Mountain. **Glade Run**, a tributary to Cloverlick Creek, joins the latter stream a few feet from its mouth but undoubtedly at an earlier date it was a tributary to Greenbrier River about 0.8 mile northwest of Clover Lick when the river flowed across the now abandoned channel that surrounds the knoll one mile west of Clover Lick.

This creek has a total length of 9.8 miles with an air-line length of 5.3 miles or a ratio of 1.84. It has a total fall of 1,580 feet, or at the rate of 161.2 feet per mile, and a drainage area of 18.17 square miles.

Laurel Run.—Laurel Run, heading 3 miles due east of Clover Lick, flows in practically a straight line to the latter place cutting a deep pass between Thorny Creek and Thomas Mountains. It has a drainage area of 3.58 square miles.

Big, Elklick, and Woods Runs.—(See table of stream data).

Sitlington Creek.—Sitlington Creek, one of the important tributaries to the Greenbrier River in Pocahontas County, has its source in **Galfred Run** high up on Allegheny Mountain. It flows in a general southwest direction to Michael Mountain where it is joined by **Shock Run**, the two uniting to cut a wide pass through this range at Dunmore, and is joined again by **Thomas Creek** $1\frac{1}{2}$ miles east of Sitlington where the parent stream empties into the Greenbrier River. Other tributaries are Moore Run, Gum Branch, Jakes Run, Stony Run, and Left Prong. Sitlington Creek has a total length of 14.5 miles with a fall of 1,980 feet, or at the rate of 136.5 feet per mile. It has a drainage area of 51.06 square miles.

Moses Spring Run.—(See table of stream data).

Deer Creek.—Deer Creek, the second largest tributary of the Greenbrier River in Pocahontas County, heads in three small branches that cut deep V-shaped valleys on the west side of Frank Mountain. Flowing in a southwest direction it has, with its tributaries, cut a broad level valley in the vicinity of Green Bank and Arbovale. It continues in a southwest direction, cutting a deep gorge, including a beautiful ox-bow one mile west of Deer Creek where it joins the river. Its tributaries are: North Fork, Rosen Run, Sutton Run, Tacker Fork, Black Run, Elleber Run, Griffin Run, Hospital Run, Riley Run, Duncan Run, Trimble Run, Buffalo Run, and Saulsbury Run. (See table of stream data). Deer Creek has a total length of 17.4 miles with a drainage area of 68.03 square miles.

Leatherbark Run.—Leatherbark Run has its source high up on the west side of Back Allegheny Mountain near Bald Knob and flows in a southwest direction to a point one-fourth mile east of Shavers Fork where it swings southeast, cutting a deep niche in Back Allegheny Mountain and joining the Greenbrier River at Cass. It has a meandering length of 5.15 miles with a total fall of 1,900 feet or at the rate of 368.9 feet per mile. Its drainage area is 6.74 square miles.

Deever, Cup, Wanless, and Trout Runs.—These are small runs heading high up on the east side of Back Allegheny Mountain and flowing with a rapid fall across the Mauch Chunk, Greenbrier, and Pocono Series to the Greenbrier River. (See table of stream data).

Allegheny Run.—Allegheny Run heads near the base of the Pottsville Series on the west side of Back Allegheny Mountain and flows southeast with rapid fall to the Greenbrier River at Hosterman. It has a length of 2.7 miles with a total fall of 1,975 feet or at the rate of 731.4 feet per mile. Its drainage area is 3.44 square miles.

Brush Run.—Brush Run heads just west of the Staunton and Parkersburg Pike on Frank Mountain and flows in a general westward course, cutting a pass between Little Mountain and Sandy Ridge to join the Greenbrier River one-half mile south of Nottingham P. O. (Boyer Station). It has a meandering length of 6.7 miles with a fall of 770 feet or at the rate of 114.9 feet per mile. It has a drainage area of 7.4 square miles.

East Fork of Greenbrier River.—East Fork, as previously stated under the description of Greenbrier River, heads in Blister Swamp, in the extreme northeastern end of the county and flows in a southwest direction to Thornwood P. O. (Winterburn Station). Here it swings to the west making a wide level valley between the latter town and Durbin where it joins the West Fork. Upon the flood-plain and terraces along this valley the towns of Durbin, Frank, Bartow, and Thornwood have been built. From Thornwood to its source Little River, Buffalo Fork, Poca Run, Abe Run, and Bennett Run flow into the East Fork from Allegheny Mountain on the east, while Reservoir Hollow, Gum Cabin Hollow, Fivemile Hollow, Bearwallow, Campbell, and Mullenax Runs join it from Burner Mountain on the west. Johns Run, heading on the southern end of Burner Mountain, flows south to join the river at Frank. The East Fork of Greenbrier River has a length of 18.8 miles with a drainage area of 69.94 square miles. (For data on tributaries of East Fork, see table of stream data).

West Fork of Greenbrier River.—West Fork of Greenbrier River heads at the Pocahontas-Randolph County line, east of Shavers Mountain and parallels the east side of this mountain in a well-entrenched meander to Durbin where it joins with East Fork to form Greenbrier River proper. From Shavers Mountain on the west it receives a few small unnamed tributaries. On the east it receives Mountain Lick Creek and Little River with its tributaries from the west side of Burner Mountain, and Mill, Gertrude, Elklick, Fox, Mikes, and Snorting Lick Runs from the west side of Middle Mountain. West Fork of Greenbrier River has a length of 16.9 miles with a drainage area of 62.62 square miles. (For data on tributaries, see table of stream data).

Anthony Creek.—Anthony Creek, the largest tributary of

Greenbrier River, has its source in Greenbrier County near the Pocahontas County line and the greater part of its drainage in Greenbrier County. It heads on Allegheny Mountain in the extreme northeast corner of Greenbrier County, but flows northwest into Pocahontas County for a distance of 1½ miles when it swings southwest to enter Greenbrier again and continues in this direction to Alvon. Here it swings more to the west cutting a deep gorge between Beaver Lick and Greenbrier Mountains to join the Greenbrier River at Anthony. Its largest tributaries are Little Creek, Meadow Creek, and North Fork of Anthony Creek. It has a total length of 28.65 miles with a fall of 1,470 feet or at the rate of 51.3 feet per mile. It has a drainage area of 146.93 square miles. Only 3.7 miles of its length is in Pocahontas County with a drainage area of 6.52 square miles.

North Fork of Anthony Creek.—North Fork of Anthony Creek has the greater part of its drainage in Greenbrier County but heads on Beaver Lick Mountain in Pocahontas County. It flows in a southwest direction between Beaver Lick and Middle Mountains to a point 1½ miles from its mouth where it swings due south to terminate the latter mountain and join Anthony Creek at Neola. It has a total length of 12.45 miles with a drainage area of 22.77 square miles.

Gauley River.—The drainage of Gauley River is of minor importance to Pocahontas County except that it has its source within the county limits, in three branches—North, Middle, and South Forks—high up on the west side of Yew and Gauley Mountains. Flowing west across the acute angle of the southern end of Randolph County these three forks unite at Three Forks of Gauley at the Randolph-Webster County line and there the main Gauley continues in a general southwest direction, draining, with its tributaries, all of Webster County south of Elk River. It continues, well entrenched, across Webster and Nicholas Counties to unite with New River at Gauley Bridge, Fayette County, to form the Great Kanawha. Its principal tributaries within the area of this report are Cherry, Cranberry, and Williams Rivers. Gauley River has a total length of 104 miles with an air-line distance of 59.2 miles or at the ratio of 1.75 and a total fall of 3.352 feet or at the average rate of 32.23 feet per mile. According to Reger[11] it has a drainage area of 1350.37 square miles.

From July 3, 1908, to September 30, 1916, the United States Geological Survey and the State Survey in conjunction maintained a gaging station on Gauley River at Allingdale, near the line between Nicholas and Webster Counties, the records of which were published in the Webster County Report and were taken from Water-Supply Papers Nos. 243, 263, 283, 303, 323, 353, 383, 403, and 433 of the former Survey.

Cherry River.—Cherry River heads in two forks, North and South, in southwestern Pocahontas County and flows west across northern Greenbrier County into Nicholas to join Gauley River at Curtin. (See table of stream data for Nicholas County).[12]

Cranberry River.—Cranberry River heads 7 miles west of Marlinton at the union of Cranberry and Black Mountains of the Yew range. It has a rapid fall from its source to the glades where it flows sluggishly across the latter for some two miles. It continues northwestward into Webster County, crossing the county line at an elevation of 2,985 feet, and flows with the same general course for 10 miles, where it swings abruptly to the southwest, and crosses into Nicholas County to join Gauley River at Cranberry Station. It has a total length of 32.35 miles with a fall of 2,035 feet or at the rate of 62.9 feet per mile. It has a drainage area of 74.08 square miles. The greater part of its watershed is covered with forest, a large part of which has been cut over in recent years. Except at Cranberry Glades the stream is swift and shallow. Its principal tributaries in Pocahontas County are Tumbling Rock Run, North Fork, and Charles Creek.

Dogway Fork.—Dogway Fork heads on the south side of Kennison Mountain near the summit and flows in a general northwest direction into Webster County to join Cranberry River 1½ miles north of Dogway. It has a total length of

[11]David B. Reger, Webster County Report, W. Va. Geol. Sur., p. 24; 1920.

[12]David B. Reger, Nicholas County Report, W. Va. Geol. Sur., pp. 22-24; 1921.

8.2 miles with a fall of 1,435 feet or at the rate of 175 feet per mile. Its drainage area is 9.73 square miles.

Birchlog and Tumbling Rock Runs.—(See table of stream data).

North Fork.—The North Fork of Cranberry River has its source on the west side of Black Mountain one mile northwest of Barlow Top. It flows in a general westerly course for 5.9 miles where it empties into Cranberry River. Near its mouth this stream has for its bed the Princeton Conglomerate for over one-half mile. (See Plate XX). It has a drainage area of 9.83 square miles. Its tributaries are Hunting Run, Cashcamp Run, and Left Fork.

Red Run and Little Branch.—Streams of minor importance. (See table of stream data).

Charles Creek.—Charles Creek, a small stream, heads just east of Blue Knob on the southern end of Kennison Mountain. It flows north for 2.35 miles and joins Cranberry River near the center of the Cranberry Glades. Its drainage area is 3.22 square miles.

Williams River.—Williams River heads 3½ miles west of Marlinton on the west side of Day and Swago Mountains with an elevation of 3,890 feet. It flows northward, cutting a deep precipitous gorge along the east side of Black Mountain, to the mouth of Laurel Creek where it turns northwestward, then continues its gorge-like valley into Webster County, with an elevation of 2,753 feet at the county line, and empties into Gauley River three miles southeast of Cowen, with an elevation of 2,155 feet, making a total fall of 1,735 feet from its source to mouth. Its length is 15.6 miles in Pocahontas County and 17.6 miles in Webster County, or a total of 33.2 miles. Its drainage area is 130.63 square miles, most of which was covered with a dense and mostly virgin forest growth until the last few years. Throughout its entire length it is a comparatively swift and shallow stream with only occasional small stretches of bottom land. Other than the temporary population of lumbermen, there are very few families living on its watershed. Its principal tributaries in Pocahontas County are Laurel Creek, Little Laurel Creek, Sugar Creek, Tea Creek, Kins Creek, and Bannock Shoals Run.

Middle Fork.—Middle Fork has its source in several small branches on the west side of Black Mountain, one of which has an elevation of 4,290 feet. The main branch flows in a northwest direction into Webster County to join Williams River at Three Forks of Williams River with an elevation of 2,350 feet, making a total fall of 1,940 feet or at the rate of 192.1 feet per mile. It has a drainage area of 27.27 square miles, all of which is covered with a dense forest growth, but recently cut over, with only one or two families living on its watershed. Its tributaries are Little Beechy Run, Beechy Run, Laurelly Branch, Hell for Certain Branch, Coal Run, and McClintock Run. Its total length is 10.1 miles.

Elk River.—(For complete description see Webster County Report).[13] Elk River, while of minor importance to Pocahontas County, has its source in Old Field Fork in this county 5½ miles north of Marlinton with an elevation of 3,500 feet. It flows northward for 13.6 miles in Pocahontas and across the southern extension of Randolph County. Near the Randolph-Webster line it veers sharply to a course south of west to four miles west of Webster Springs, where it turns northwest and so continues until it crosses the Webster-Braxton County line near Centralia. From here it flows to the west to Sutton where it again turns to the southwest and empties into the Great Kanawha River at Charleston. Including its tributaries of Dry Fork, Old Field Fork, and Big Spring Fork, it has a drainage area in Pocahontas County of 75.64 square miles. Except near its source, where it flows across the Mauch Chunk Series, its entire course in Pocahontas is across the calcareous Greenbrier Series where it occasionally sinks beneath the surface to appear again farther down the valley.

Tygart River.—(For description and data on Tygart River see Barbour, Upshur and Western Portion of Randolph County Report). Tygart River, which forms the principal drainage basin of Barbour and a large portion of Upshur and

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[13]David B. Reger, Webster County Report, W. Va. Geol. Sur., pp. 26-37; 1920.

Randolph, has its source one mile west of Spruce in Pocahontas County with an elevation of approximately 4,000 feet. After flowing west for two miles it enters Randolph County where it flows in a general northward direction across Randolph, Barbour, and Taylor to join the West Fork at Fairmont, Marion County, to form the Monongahela. Its length in Pocahontas County is 2.2 miles with a drainage area of less than three square miles.

Shavers Fork.—Shavers Fork of Cheat River heads on the south end of Back Allegheny and Cheat Mountains with an elevation of 4,600 feet and flows northward through the basin between these mountains into Randolph County. It continues across the latter county and into Tucker County where it is joined by Dry Fork at Parsons to form Cheat River proper. Throughout its entire course it follows rough topography, mostly that of the Pottsville and Mauch Chunk Series, and hence is a region of small development with few towns along its watershed. Its tributaries in Pocahontas County are Black and Rocky Runs, and First and Second Forks.

MINOR DRAINAGE CHANGES.

In view of the network of drainage basins in Pocahontas there are few examples of evident changes in drainage. One example, however, is found at Clover Lick. It is the writer's interpretation that Greenbrier River formerly circled the knoll west of Clover Lick but later captured itself by cutting a channel across the point where the town of Clover Lick now stands. This is evidenced by the old river channel surrounding this knoll but now occupied, in part, by Cloverlick Creek and Glade Run.

A somewhat similar condition is presented at Wesley Chapel four miles northeast of Dunmore. The region is known locally as "Glade Hill". It is the writer's interpretation that what is now Thorny Branch, flowing into Sitlington Creek one-fourth mile east of Hillside School, originally flowed through the low gap at Wesley Chapel. A beautiful long narrow terrace now divides the two streams. (See Plate X).

IMMINENT CAPTURE.

A fine example of imminent capture can be seen in Shavers Fork of Cheat River four miles northwest of Cass. The stream with a gradual fall flows leisurely along the surface of an old plateau, while Leatherbark Run, a tributary of the Greenbrier River drainage, is rapidly eating its way into the plateau scarp. Leatherbark Run has a rapid fall with an average of 368.9 feet per mile, with the upper end falling more than 1,000 feet in less than 1½ miles. At the present time it is within 1,060 feet of Shavers Fork and in the near future, geologically speaking, the upper two miles of Shavers Fork will become a part of the Greenbrier River drainage, rapidly descending the falls, due to forthcoming capture, into the deep gorge which well marks the sharp elbow of capture.

Deer Creek.—A beautiful double ox-bow loop can be seen one mile east of Cass where Deer Creek in an entrenched meander flows nearly 1½ miles to get 0.1 mile nearer its mouth. In the early geologic future this stream will cut across the narrow neck and capture itself to eliminate the roundabout meander.

MINOR TOPOGRAPHIC FEATURES.

Limestone Sinks and Caverns.—Sink-holes and caves are intimately associated. The former are surface features readily recognized, while the latter are entirely subterranean and produce no noticeable effect upon the surface configuration of the surrounding country. Sink-holes vary as to size, shape, and depth, but are ordinarily cave-shaped, and unless folded in, drain out through an opening in the lowest part. These sinks may be formed either by openings left by soil washing through crevices, or the large ones, particularly with steep walls, may be produced by the collapse of the roof of an underlying cavern. In either case they are connected with underground channels which are called caves.

In the vicinity of Hillsboro minor sinks are noticeable while in and around Lobelia the entire area is composed of sinks and caverns. The entire drainages of Hills Creek and Bruffey Creek descend into a large sink to pass through an underground channel beneath Droop Mountain.

Known caverns in Pocahontas County are, Saltpeter Cave at the head of Swago Creek, Overholt Blowing Cave near McClintock's mill, and Sneadeger Cave west of Droop Mountain near the Greenbrier County line. The latter cave was the only one explored by the writer. In company with Calvin W. Price, Jos. McNeel, and Henry McNeel a trip was made into this cave. It is plainly an abandoned stream channel, but still active in rainy weather, with the bottom littered with sand, gravel, boulders, tree branches, and logs. The elevation at the mouth is 2,450 feet, while at the end, one-half mile in, where the opening was too small to penetrate, the elevation is 2,315 feet, making a fall of 135 feet. An occasional large stalactite or stalagmite was encountered but as a whole it is almost without these formations. One large room measured 100 feet wide by 300 feet long with a height of 25 feet. Several of the county's large limestone springs emerge from underground channels.

PART II.

Geology.

CHAPTER III.

GEOLOGIC HISTORY AND CORRELATION OF ROCKS.

DERIVATION OF SEDIMENTS.

The outcropping rocks of Pocahontas County are entirely of sedimentary, or clastic, origin—that is, they were deposited by water. They consist of sandstone, shale, and limestone, all of great variety in composition and appearance. These materials were originally gravel, sand, and mud, derived from the waste of older rocks, chemical precipitates from enclosed seas, and the remains of animals that lived in the seas while the strata were being laid down. Some of the limestones are made up largely of shells of various sea organisms. The abundance of plant growth will, under suitable conditions, often form thick seams of coal. Other than the western portion of the county, or west of Greenbrier River, the rocks are all older than the true Coal Measures.

The rocks reveal the unwritten history of the sedimentation from early Silurian to the Kanawha Group of Pennsylvanian time. From their composition and appearance a great deal can be inferred as to the conditions under which they were deposited. For example, sandstones marked by ripples and cross-bedded by currents, or shales cracked by drying on mud-flats, indicate shallow water, while limestone with marine fossils indicates deeper water. Not only can the condition of the sea be determined but also the character of the adjacent land. The sand and pebbles of coarse sandstone and conglomerate, such as are found in the Lower Carboniferous, show that the adjoining land may have been high and the stream gradient steep. The pebbles may have been repeatedly redistributed back and forth by wave action, over a rising and sinking coast-line. Red beds such as the Red Medina, Catskill, Maccrady, and Mauch Chunk Series are indicative of continental deposits formed in an arid climate. If limestones are deposited near shore the adjacent land must be low and the streams too sluggish to carry off the coarser sediments.

The seas in which these local sediments were laid down covered an extensive area, including the western part of the Appalachian Province and extending westward to the central States of the Mississippian basin. The sediments were derived from a large mountain range, or crystalline land mass, designated as **Appalachia,** to the east and southeast, or near what is now the Atlantic coast.

An idea of the composition of this ancient continent can be gained from a study of the present rocks. These rocks are composed largely of silica in the form of sand grains, with occasional conglomerates of quartz pebbles, flakes of mica, feldspathic material, alumina, compounds of iron, and lime. From the fact that the chief components of granite are quartz, mica, and feldspar, it is inferred that this constituted the greater part of Appalachia.

Reasoning in this manner it is supposed that during the deposition of the older formations, such as the Cambrian and Ordovician (not exposed in Pocahontas County), the continent to the east was high and rugged and probably of crystalline origin, the erosion of which furnished the bulk of sediments for these periods. In the later Silurian, when the limestone of the Salina Formation was deposited, the eastern continent was nearly base-leveled and had a subsiding coast-line, thus permitting a transgression of the sea.

The Devonian Period following the Silurian is one of abundant sandstone and shale, and marks another uplift of the eastern land, along with some of the recent residual Silurian deposits followed by a period of erosion.

The thick deposits of red shale and sandstone of the

Mauch Chunk Series, especially in the more northern areas, are regarded by some authorities as continental beds formed in an arid climate. The salient features of this series are its general red color, scarcity of marine fossils, abundance of sun-cracks, impressions of reed-like plants, presence of thin nodular limestones, lack of concentrated deposits of iron ore, and at its type locality tracks of amphibians. In its upper portion are thin seams of coal. The red color is due to hematite in a disseminated form. These features are regarded by Barrell[1] as proof that these sediments were laid down as a delta deposit in a semiarid climate. In southern West Virginia, however, marine conditions often occurred.

At the close of Mauch Chunk time, there existed a broad, low-coasted plain, bordering a vast expanse of shoals, ferruginous mud-flats, with ripple-marks, mud-cracks, rain-prints, and, in some localities, fossil tracks. This was followed by an orogenic movement producing subsidence under loading, with stability at intervals, sufficient for a growth of vegetation to form coals. The early subsidence was most pronounced along the east shore with a westward transgression of the sea. In early Pottsville time occasional marine fossils occurred in Pocahontas County and other parts of West Virginia.

With the exception of Quaternary or Recent materials the Pottsville sediments are the youngest now remaining in the county.

FOSSIL STAGES.

The use of the term fossil is no longer limited to the remains of plants and animals, but is more comprehensive, and includes their tracks, impressions, casts, replacements, and other distinct traces. It also includes nests, borings, implements, and other distinct evidence of former life. These constitute a specific record of life, a study of which not only reveals the past history of plants and animals, but furnishes one of the best means of determining the age of formations. In cases where the rocks have not been disturbed it would be

[1]Joseph Barrell; Bull. Geol. Soc. Am., Vol. XVIII, pp. 44 and 476.

expected that the uppermost or youngest would contain fossils that are more nearly like those now living, while beds lying beneath these bear evidence of organisms that differ materially from those now living and hence are less highly developed. The beds still lower diverge farther and farther from the living types and are simpler in form, as far down as fossils are found.

By a study of the successive beds in regions where the strata are undisturbed, plants and animals are found to present a more or less progressive evolution, with gradual modifications of forms, and these modifications are helpful in determining the order of succession in regions where the strata have been disturbed.

That the record of life is so imperfect is not due to the lack of former life itself but due to the fact that in early times conditions were unfavorable to the preservation of the relics of life. Marine life is much more complete than land forms because of the fact that marine forms are laid down in positions favorable for preservation, while land forms such as plants, and other terrestrial organisms ordinarily die in places unfavorable for preservation. Land conditions favor decomposition, transportation, and erosion, and only under exceptional conditions do land forms leave a good record of their life.

The oldest rocks exposed in Pocahontas County are the Red Medina Series of Silurian age, composed of sandstone and shale, and may be seen to the best advantage along the Knapp Creek gorge east of Huntersville. The Red Medina Series has been considered non-fossiliferous, but at this locality some rounded, curved, and branching forms were collected that are judged by Dr. Tilton to be evidence of algae. The overlying White Medina (Clinch, Tuscarora) contains **Arthrophycus harlani,** and **Scolithus,** the affinities of which are not well established, and also fucoids.

The remaining Silurian beds, Clinton, Niagara, Rondout, and Bossardville, reveal a vast assemblage of marine forms.

Following the Silurian Period comes the Devonian with a rich assortment of marine life with a remarkable assemblage of fossil plants, many of which, however, are poorly preserved because of the conditions under which they were laid down.

In the overlying Mississippian Period marine fossils are numerous, with great numbers of certain genera, as **Composita, Pentremites, Lithostrotion,** etc. The Pocono, Greenbrier, and Mauch Chunk are rich in marine assemblages, while the Pocono contained sufficient vegetation to produce thin coals followed by a cessation in the Greenbrier, but to recur in the Mauch Chunk again to form thin coals.

In the succeeding Pennsylvanian, marine life was scarce, but with a luxuriant vegetation to form true coals.

Further discussion of fossil life will be found under the separate series headings.

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NOMENCLATURE AND CORRELATION.

In Pocahontas County, the problem of proper nomenclature, along with accurate correlations, involves a selection from equivalent titles that have been given the same formations in different regions. In the present instance this discrimination must be made from the published columns and generally accepted terms in the respective localities of the surveys that have been made in adjoining areas, and in part the local area. These are principally the State Surveys of New York, Pennsylvania, and subsequent eastern States; those of Virginia and other southern Appalachian States; those of the general Mississippi Valley; the U. S. Geological Survey; and more especially the column of the West Virginia Geological Survey. Fortunately, general revision is unnecessary, but early deductions must be affirmed, while many of the local names must be considered as such, so that original titles of which there is no longer a doubt may be properly applied.

In this report as in all the West Virginia Geological Survey reports an attempt is made to recognize and follow the earliest nomenclature of authentic publications that have had general circulation and are of sufficient detail to follow.

In the Pennsylvanian Period the nomenclature of the Second Geological Survey of Pennsylvania, as far as it is applicable, and the amplified Pottsville nomenclature of southern West Virginia, as used in numerous reports of the West Virginia Geological Survey, is employed.

In the Mississippian Period it is necessary to choose between the distinct nomenclatures of the East and the West. In this Period four major series are easily recognized. Particularly is this true in southern West Virginia, where, until the last few years, detailed study, with subdivisions of the four series, had not been made. In the Mercer, Monroe, and Summers County Report, however, Reger's careful and detailed study established the relationship of these rocks to those of the East and the West. Because of the close proximity and similarity of conditions the same nomenclature is herein retained so far as applicable. It is true that even in this short distance considerable thinning has occurred but the same major groups have carried through the entire county.

In the Devonian and Silurian it has been the policy of the West Virginia Geological Survey to retain the New York nomenclature where possible. Many of the important subdivisions, although somewhat attenuated, are easily recognized across the State.

In Chapters VI to XI, inclusive, where the various subdivisions are discussed in detail, the nomenclature of several organizations and authors is included, together with that adopted in this report, which should serve to harmonize conflicting names.

CLASSIFICATION OF OUTCROPPING ROCKS.

Figure 4 is a general columnar section of the outcropping rocks of Pocahontas County, indicating the maximum and minimum thicknesses of all subdivisions of sufficient importance to be mapped geologically, followed by a brief description of their most salient features. Further descriptions and subdivisions are included under the discussions of each series in Chapters VI to XI, inclusive.

FIG. 4

GENERAL COLUMNAR SECTION OF ROCKS EXPOSED IN POCAHONTAS CO.

Vertical Scale. 1 inch = 1000 feet.

ERA	PERIOD OR SYSTEM	SERIES	MAP SYM.	SECTION	THICKNESS FT.	TOTAL FEET	DESCRIPTION
QUATER.	RECENT		Qal		?	?	Unconsolidated clays and gravel. (River wash)
QUATER.	PLEISTOCENE		Qal		?	?	Unconsolidated clays and gravel (River terraces)
PALEOZOIC	UPP. CARB. PENNSYLVANIAN	POTTSVILLE: Kanawha Grp (Part)	Ck		130	250	Massive gray ss.; gray sandy and dark carbonaceous shale; coals; fresh or brackish water fauna; plant fossils.
PALEOZOIC	UPP. CARB. PENNSYLVANIAN	POTTSVILLE: New River Group	Cnr		500	600	Massive gray ss.; gray sandy and dark carbonaceous shale; coals; fresh or brackish water fauna; plant fossils.
PALEOZOIC	LOWER CARBONIFEROUS MISSISSIPPIAN	MAUCH CHUNK: Bluestone Group	Cb		75-200	930	Red, green & variegated shale; green, gray & brown massive and flaggy ss.; thin streaks of coal; marine & plant fossils.
PALEOZOIC	LOWER CARBONIFEROUS MISSISSIPPIAN	MAUCH CHUNK: Princeton Conglom.	Cpr		50-70	1,000	Massive gray & brown ss. with variegated pebbles; plant fossils.
PALEOZOIC	LOWER CARBONIFEROUS MISSISSIPPIAN	MAUCH CHUNK: Hinton Group	Chn		500-700	1,700	Red, green & variegated sandy shale; gray red & brown ss., massive ss. at base (Stony Gap); weathers white; marine & plant fos.
PALEOZOIC	LOWER CARBONIFEROUS MISSISSIPPIAN	MAUCH CHUNK: Bluefield Group	Cbf		550-800	2,500	Brown, red, green, variegated, argillaceous, calcareous and fissile shale; massive and flaggy ss.; limestone in lower part, coal streak, abundant marine tauna; some plant fos.
PALEOZOIC	LOWER CARBONIFEROUS MISSISSIPPIAN	Greenbrier	Cgr		220-600	3,100	Dark, gray, blue, or light-gray with streaks of red shale below middle; dark brown shale near top; lower portion cherty with coral bed; numerous marine foss.
PALEOZOIC	LOWER CARBONIFEROUS MISSISSIPPIAN	Maccrady	Cmc		20-50	3,150	Deep red, purple, shale, with siliceous ls. at top (Warsaw); sparse marine fauna.
PALEOZOIC	LOWER CARBONIFEROUS MISSISSIPPIAN	Pocono	Cpo		60-600	3,750	Brown or red cross-bedded ss. with quartz cong. at base & top; gray & green thin ss. & shale; semi-anthracite coal; numerous marine fossils & land plants.
PALEOZOIC	UPPER DEVONIAN	Catskill	Dck		400-840	4,590	Mostly red shale & ss.; occasional conglomerate; in northern end of county, gray heavy ss. with green, red & brown shale; marine fauna; plants; shark teeth and plates

FIG. 4.
GENERAL COLUMNAR SECTION
(CONTINUED)

ERA	PERIOD OR SYSTEM	SERIES	MAP SYM.	SECTION	THICKNESS. FT.	TOTAL FEET	DESCRIPTION
PALEOZOIC (continued)	UPPER DEVONIAN (continued)	Chemung	Dch		3,000–3,175	7,765	Gray, green, brown, massive and flaggy sandstone, interbedded with gray, green, arenaceous and argillaceous shale; sandstone conglomerate at top (Hendricks): abundant marine fossils with some plants, including silicified tree trunks
		Portage	Dp		2000–2410	10,175	Gray, green, sandy and argillaceous shale interbedded with grayish green and brown flaggy sandstone; sparse marine fauna; land plants.
		Genesee	Dg		50–150	10,325	Brown to black slaty shale; marine f.

Fig. 4.

GENERAL COLUMNAR SECTION (CONCLUDED)

ERA	PERIOD OR SYSTEM	SERIES	MAP SYM	SECTION	THICKNESS. FT.	TOTAL FEET	DESCRIPTION
PALEOZOIC (continued)	MIDDLE DEVONIAN	Hamilton	Dhm		100-100	10,425	When present, dark brown sandy shale; sparse fossils.
		Marcellus	Dm		500 ±	10,925	Black, carbonaceous, fissile slickensided shale; thin limestone in lower portion, marine fauna.
	LOWER DEVONIAN	Oriskany	Do		75-100	11,025	Upper part light yellow to gray, sandy chert; lower part brown ferruginous ss.; marine fauna throughout.
		Helderberg	Dhl		200-300	11,325	Massive blue, tough, cobbly limestone; Stromotopora reef near top; marine fauna.
	SILURIAN — SALINA SERIES	Bossardville	Sbo		325-600	11,925	Blue to gray massive platy ls.; occasional calcite streaks; marine fauna.
		Rondout	Srd		100-150	12,075	Hard, flaggy, brittle ls.; sparse fauna.
		Bloomsburg			25-0	12,075	Grayish-brown, flaggy quartzite
	SILURIAN	Niagara	Sng		50-100	12,175	Dark and yellow shale with thin ls.; marine fauna.
		Clinton	Scl		500-600	12,775	Massive gray and red (iron) ss. in lower part; variegated shale near middle, with thin ls. in upper portion; quartzite at top; marine fauna-fucoids.
		White Medina	Swm		50-160	11,935	Massive white very hard quartzite. Scolithus and fucoids.
		Red Medina	Srm		400-600	13,535	Deep red shale alternating with red and reddish-brown candstones, no fossils found.

CHAPTER IV.

STRUCTURE.

METHODS OF GEOLOGIC WORK AND REPRESENTATION OF STRUCTURE.

In determining the structure, or position, of the rocks in Pocahontas County the same method of geologic work may not be applied with good results in all parts of the county. In the area west of the Greenbrier River where the rocks have been only slightly disturbed and where the original strata are still approximately horizontal, there are some well-defined, undistorted, and easily recognized beds, where it is possible to measure thicknesses and determine dips over wide areas by means of aneroid barometer levels, with as much accuracy as circumstances may require.

In this region a structure map has been made, showing the position of the base of the **Sewell Coal** of the New River Group of the Pottsville Series from the limited information available in the region where this coal occurs. The area includes what is probably the most inaccessible and least inhabited region in the State. The greater part is cut-over timber land on which a second growth is now almost impenetrable. The streams, along which the best exposures are ordinarily found, are now cluttered with heavy talus from the higher levels, and discarded logs and branches from former timber operations often interspersed with briers, alders, and hobble-bush that now conceal any outcrops of bed-rock which might have formerly been exposed. Furthermore there are no commercial operations in the county at the present time. The known exposures are mostly limited to those found by local woodsmen on hunting trips. Even these are hard to locate by the same woodsmen on a second trip.

The Sewell Coal was used so as to connect the structure on with that shown on maps of adjoining counties where this coal was traced in Webster up to the county line on the west by David B. Reger as well as on the north in Randolph County. The elevation of its base above sea-level is shown by **green structure contours** on Map II, and since other horizons lie nearly parallel to it the contours on this stratum may be used to determine the position of other beds above or below it by either adding or subtracting the proper interval. The Sewell Coal outcrops over a large part of this area. Along the western boundary its elevation is roughly midway between stream level and the tops of the mountains with a rapid rise to the east.

The detailed work necessary to prepare the structure map included several hundred observations on the key-horizon and other known stratigraphic horizons. Elevations were obtained mainly by the use of the aneroid, checked on the nearest Government spirit-level determination as recorded on the topographic maps.

There is considerable variation between the different stratigraphic horizons due to the thickening of the measures mainly to the southwest. In order that this fact might not destroy the purpose of the structure map, a table of intervals was prepared from numerous detailed stratigraphic cross-sections and measurements of intervals from place to place. The principal results of these observations are condensed in the following table which shows intervals above and below the Sewell Coal. These tables were used in determining the contours on the key-horizons in localities where direct observations could not be made:

Intervals Above and Below Sewell Coal, Pocahontas County.

Formation.	Briery Knob.	Dogway.	Edray.	Forks of Cranberry.	Slaty Fork.	Snyder Knob—Hopkins Mine.	Stony Bottom.	Tea Creek (Mouth).	Three Forks of Gauley.	Three Forks of Williams.
Gilbert Coal	....	....	....	....	....	250	....	550	450	550
Upper Nuttall Sandstone (top)	....	370	....	400	300	200	....	310	400	350
Hughes Ferry Coal	....	310	....	200	150	125	....	....	225	200
SEWELL COAL	0	0	0	0	0	0	0	0	0	0
Upper Raleigh (Sharon) Sandstone (base)	75	....	....	....	125	75	100	85	130	150
Fire Creek Coal	....	165	....	190	....	115	....	....	....	....
Base of Pottsville	....	175	....	200	175	115	....	150	....	200
Princeton Conglomerate (top)	300	250	265	300	250	....	265	240	....	250
Stony Gap Sandstone (top)	775	....	750	....	750	....	840	....	....	....
Greenbrier Limestone (top)	1800	....	1810	....	1550	....	1800	....	....	....

East of the Greenbrier River where orogenic disturbance has been much more severe, different methods of stratigraphic work are necessary. In this part of the area the rocks have been greatly mashed, leaving them tilted, vertical, and in some cases slightly overturned. In such cases the aneroid and level are of small value, but the combination clinometer and pocket transit takes their place. By using the accurate topographic maps many cross-sections across the dip were made, and accurate contact lines of the different series mapped. These cross-sections have been plotted to a scale of 1:62,500 both horizontally and vertically and appear on the margin of Map II. In other localities, where conditions were favorable, horizontal measurements were made across the dips to secure data for compilation of thickness by trigonometric formulas, and the resulting sections, along with those vertically measured in the western part of the county, appear in Chapter V under the heading of "Measured Sections".

ANTICLINES AND SYNCLINES.

In the region west of the Greenbrier River the strata have, with one exception, a general dip to the west and form the eastern limb of the Kovan Syncline of Webster County.[1] This exception is the reversal found between Mace and the eastern end of Red Lick Mountain, that forms the eastern limb of the Deer Park Anticline or the western limb of the North Potomac (Georges Creek) Syncline. As pointed out in previous pages the strata are so gently folded as to permit structure contouring. East of the Greenbrier River, however, the anticlines and synclines become bold features which largely control the direction, shape, and height of the mountains, as well as exerting considerable influence on the drainage basins. The major anticlines and synclines will be described in the order of their occurrence from west to east. The major folds are as follows:

[1]David B. Reger, Webster County Report, W. Va. Geol. Sur., 1924, pp. 61-62.

Deer Park Anticline,
North Potomac (Georges Creek) Syncline,
Blackwater Anticline,
Browns Mountain Anticline,
Job Syncline,
Horton Anticline,
Stony River Syncline.

Deer Park Anticline.—The Deer Park Anticline of Martin[2] has been traced from Pennsylvania on the north, across Maryland and into West Virginia at the extreme southeastern corner of Preston County and continues on across Tucker and Randolph Counties. It enters Pocahontas from Randolph 0.4 mile west of Mace and continues in a general southwestern direction for a distance of 11¼ miles, passing just west of Linwood and terminating on the eastern end of Red Lick Mountain. Throughout its course in Pocahontas County the outcropping rocks are the basal groups of the Mauch Chunk Series and the upper portion of the Greenbrier Series.

North Potomac (Georges Creek) Syncline.—The North Potomac Syncline of Darton and Taff,[3] or Georges Creek Syncline of O'Harra,[4] is one of the most pronounced structural features in Pocahontas County. This syncline has been traced from the Pennsylvania-Maryland State line across Maryland into West Virginia and forms the principal basin that affects the Carboniferous strata of Mineral, Grant, and Tucker Counties. It continues across Randolph County to Shavers Fork of Cheat River a short distance east of Bowden Station and from this point closely follows the valley of Shavers Fork into Pocahontas County. It enters this county between Cheat and Back Allegheny Mountains and continues to their southern termination where it passes one mile west of Thorny Flat to die out just north of Gay Knob. The presence of this syncline in the counties to the north is of vast importance. In Mineral, Grant, and Tucker as well as the adjoining county of Randolph, it has retained many valuable coal beds in which there is now and will continue to be exten-

[2]G. C. Martin, Accident-Grantsville Folio, No. 160, U. S. Geol. Sur.; 1908.

[3]N. A. Darton and J. A. Taff, Piedmont Folio, No. 28, U. S. Geol. Sur.; 1896.

[4]C. C. O'Harra, Allegany County Report, Maryland Geol. Sur., pp. 150-152; 1900.

sive mining operations. In Pocahontas County, however, because of its rapid rise to the southwest the coals were elevated to such a degree that erosion has removed the greater portion of the coal that was once present.

This anticline from the point at which it enters the county to its southern termination is 16 miles long, nearly symmetrical in form, with a general rise to the southwest. From the Randolph County line to the southern end of Cheat and Back Allegheny Mountains on Thorny Flat the principal rocks are of basal Pottsville Series with the upper portion of the Mauch Chunk Series exposed along the streams. South of Thorny Flat an entire section of the Mauch Chunk formation is exposed with the greater portion of the Greenbrier Series above drainage along Cloverlick Creek.

Blackwater Anticline.—The Blackwater Anticline of Darton and Taff[5] has its origin in the vicinity of Chaffee, Mineral County, and extends southwestward into Maryland roughly paralleling the West Virginia-Maryland State line to a point one mile southeast of Gormania where it continues southward to the Grant-Tucker County line and continues across Tucker County southwestward through the Canaan Valley into Randolph County. It has been traced by Reger[6] entirely across Randolph County to the Pocahontas County line where it enters the latter at a locality two miles northeast of Wildell and continues in a southwestern direction for a distance of 13½ miles passing through Frank and apparently dying out in Sandy Ridge. Along the Staunton and Parkersburg Pike several minor folds are encountered, including some mashing in the thinner Chemung sandstone and shale, between Durbin and Bartow so as to make the main axis somewhat uncertain. After careful field examination, however, the main axis was located as passing directly through Frank and terminating a short distance farther south but at the same time interfingering with the more complexly folded region to the southeast that is mapped as the Browns Mountain Anticline. The outcropping rocks along the axis of this fold are entirely of Chemung age.

[5]N. H. Darton and J. A. Taff, Piedmont Folio, No. 28, U. S. Geol. Sur.; 1896.

[6]Personal interview.

Browns Mountain Anticline.—Under the head of Browns Mountain Anticline will be discussed the complex, folded area or anticlinorium, that is so conspicuous along Knapp Creek between Huntersville and Minnehaha Springs and that extends southwestward along Brushy and Beaver Lick Mountains into Greenbrier County and to the north along Browns and Michael Mountains, through Green Bank and ending approximately one mile northeast of Bartow.

The Browns Mountain Anticline of Darton[7] which is the most conspicuous structural feature in Pocahontas County, has its source in a number of small folds between the southern ends of Blackwater Anticline and Job Syncline near Bartow. It continues southwestward roughly paralleling the State road to Green Bank where much evidence of squeezing can be seen, and from this locality the main axis connects with the top of Michael Mountain. Along the State road east of Dunmore a series of folds is encountered with squeezing and mashing. The Oriskany Series one-fourth mile east of Dunmore is overturned with a 55-degree dip to the southeast, while three-fourths mile farther east the Bossardville platy limestone has been squeezed almost to the point of flowage. One-half mile farther east from the latter point a low, graceful, single arch of the White Medina constitutes the main axis of this folded area and marks the northern end of this series that is so prominently developed between Huntersville and Minnehaha Springs. At the southern end of Michael Mountain the main axis trends somewhat abruptly to the southwest and crosses the Browns Creek-Frost road 1.3 miles east of Thorny Creek School. From this point southward the major fold holds to the western side of Browns Mountain but in the gorge of Knapp Creek its true nature as an anticlinorium becomes more apparent, there being another fold of equal magnitude just west of the Minnehaha Springs bridge. A detailed cross-section was prepared to give a better idea of the complexity at this locality and can be seen on Figure 17, page 272.

The rocks exposed in this fold include those of the Chemung Series of the Upper Devonian down into the Red Medina Series of the basal Silurian. Both the eastern and

[7] N. H. Darton, Monterey Folio, No. 61, U. S. Geol. Sur.; 1898, p. 6.

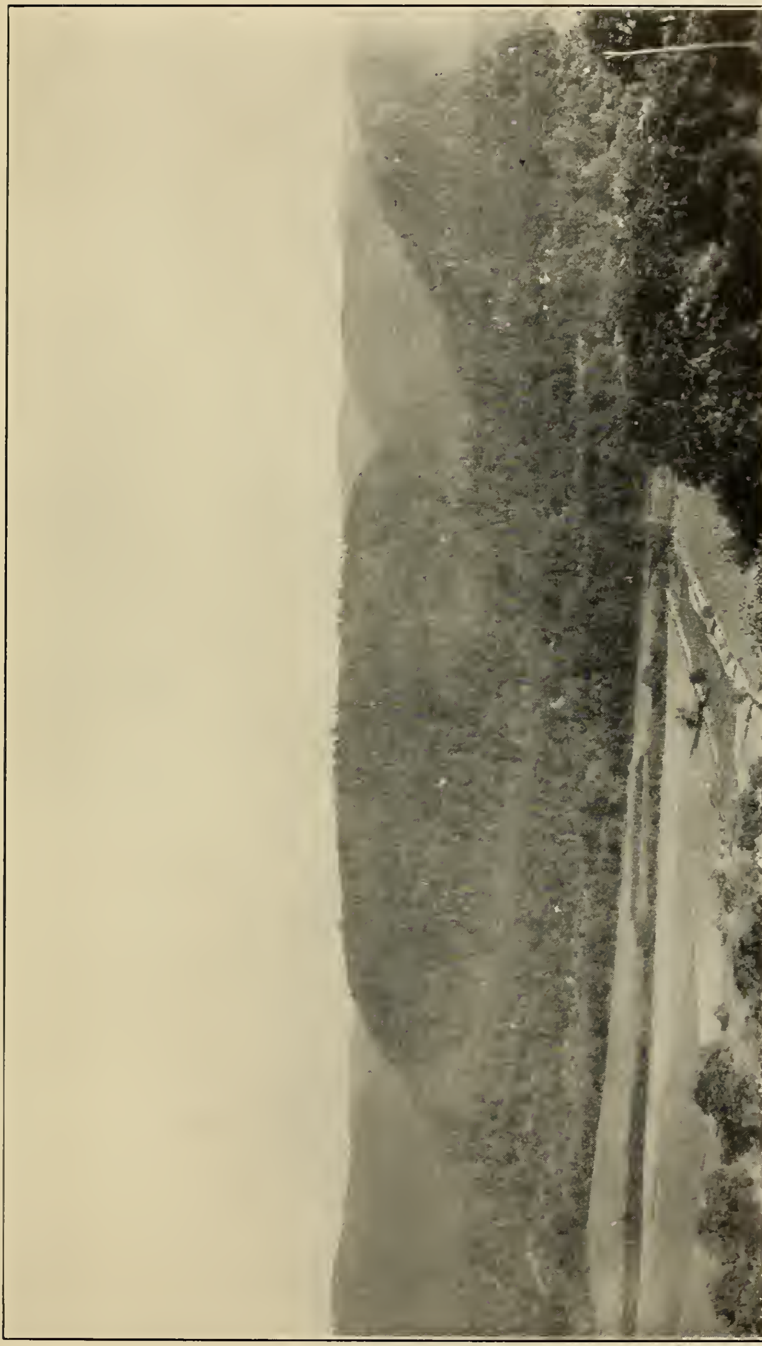

PLATE XI.—Looking east across Greenbrier River south of Marlinton. The crests of the ridges making the even sky-line mark the Harrisburg Peneplain. (Photo. by Paul H. Price).

PLATE XII.—View north across Huntersville with Marlin Mountain in background. (Photo. by Paul H. Price).

PLATE XIII.—View of Frost looking east. Middle Devonian Shales form the valley in the foreground. Allegheny Mountain in the background composed of Upper Devonian Sandstones and Shales with an occasional high knob capped with Pocono. (Photo. by Paul H. Price).

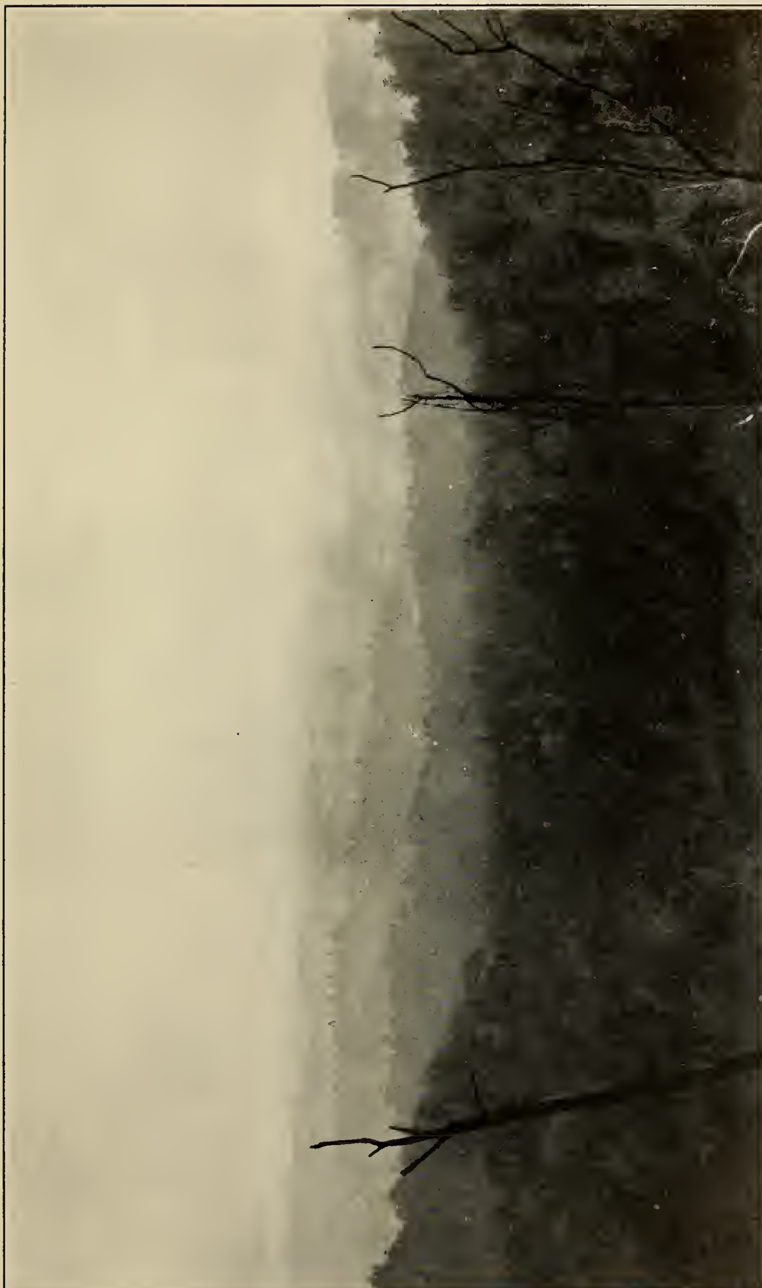

PLATE XIV.—View west from Lookout Tower on Michael Mountain after a warm shower. (Photo. by Paul H. Price).

western flanks are composed of rocks standing at steep dips and occasionally overturned somewhat beyond the vertical. At Michael Mountain this anticline attains its greatest altitude, bringing the White Medina quartzite to the surface along the crest of that ridge. This same series is exposed in the arch 1.7 miles east of Dunmore and is also well exposed, with the underlying Red Medina, in the gorge of Knapp Creek between Huntersville and Minnehaha Springs. It is also the principal ridge rock in Beaver Lick Mountain. Much of the area of this anticline is composed of the Silurian limestones, but there are a number of ridges composed of the Clinton quartzites. The remaining ridge maker is the Oriskany Series that flanks this entire anticline on either side in low ridges which slope down to the Lower Devonian shale depressions that surround the mountains.

Job Syncline.—Job Syncline (new) originates in the northeastern corner of Randolph County in the lower valley of Red Creek and continues southwest, crossing Dry Fork to Rich Mountain just west of Job. From this locality it follows the latter mountain to the Pocahontas County line at the western side of Blister Swamp on Burner Mountain between the Blackwater and Horton Anticlines. After entering Pocahontas at the crest of Burner Mountain it continues southwest for 11½ miles, following the eastern side of this mountain, and passes just east of Thornwood to terminate north of the Staunton and Parkersburg Pike on Frank Mountain.

The only exposure of the Greenbrier Limestone east of the Greenbrier River in Pocahontas County is along the axis of this syncline and this outcrop is limited to the Blister Swamp area.

Horton Anticline.—The Horton Anticline of Tilton,[8] named Horton at the suggestion of D. B. Reger, originates near the Pendleton-Tucker County line and continues southwest across Pendleton County into Randolph County two miles east of Horton and follows the crest of Allegheny Mountain, roughly paralleling the Randolph-Pendleton County

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[8]John L. Tilton, Wm. F. Prouty, and Paul H. Price, Pendleton County Report, W. Va. Geol. Sur., p. 240; 1927.

line to the common corner of Pendleton, Randolph, and Pocahontas Counties. From this point it continues into Pocahontas County 11 miles, passing just west of Burning School and terminating in the region north of Top of Allegheny. Within the limits of this county the surface rocks along the axis of this anticline are entirely of Chemung age.

Stony River Syncline.—The Stony River Syncline of Darton and Taff[9] is a branch of the North Potomac (Georges Creek) Syncline originating in Mineral County and continuing southwestward into Grant one mile southwest of Wabash. In Grant County it continues southwestward to a crossing of Stony River one mile northwest of Mount Storm, thence across Grant to the Tucker County line near the head of Stony River and through the latter county to the Randolph County line two miles east of Laneville. From this line it crosses the Roaring Plains into Pendleton and across Seneca Creek at Onego. In the latter county its axis is along the crest of Spruce Mountain. From Spruce Mountain it passes on into Highland County, Virginia, two miles east of the common corner of Pendleton, Pocahontas, and Highland. From this point it remains in the latter county for nine miles and enters Pocahontas County at a point where the Staunton and Parkersburg Pike crosses the State line, 2.2 miles east of Top of Allegheny. From this locality it continues southwestward in Pocahontas 10½ miles where it again enters Highland County and remains in this county 2.7 miles to a point where the Frost-Monterey road crosses the State line. South of this point it follows in general the State line to Laurel Creek, where the main axis is found one mile west of Rimel, and continues in this same direction into Greenbrier County. At Rimel a small anticline, dividing the main basin into two synclines, appears. Here the axis of the main basin is just east of Middle Mountain, while the other lies between Allegheny Mountain and Little Mountain, Virginia. In Pocahontas County this structural basin is a broad gentle syncline, with occasional smaller depressions within the main fold, the erosion of which has left the Allegheny Mountains, composed almost entirely of Upper Devonian shales, with an

[9]N. H. Darton and J. A. Taff, Piedmont Folio, No. 28, U. S. Geol. Sur.; 1896.

occasional high knob retaining the basal Pocono Series. The length of this syncline from the Staunton and Parkersburg Pike to the Greenbrier line is 35 miles.

CROSS-SECTIONS.

East of the Greenbrier River the rocks in Pocahontas County have been too greatly distorted to be used as the basis of a structure map, often standing at steep dips and in some cases slightly overturned, or otherwise so disturbed that structure contouring is not possible. In this region six cross-sections have been prepared to show in a graphic manner the position of the various beds. All these cross-sections have been made on a vertical and horizontal scale of 1:62,500 or 5,208 feet to the inch, which is the same scale as the topographic maps, all of them extending approximately at right angles to the line of strike, and being so spaced as to include the largest numbers of interesting features.

Cross-Section A—A′.—Cross-Section A—A′ is 8.5 miles long, beginning at the Randolph-Pocahontas County line on Back Allegheny Mountain and extending southeast, just touching the southern end of Randolph County, to the Pendleton County line on Allegheny Mountain. The section begins in the Pottsville Series on Back Allegheny Mountain and quickly descends to the Catskill Series at the West Fork of Greenbrier River, and continues east across the broad Blackwater Anticline and Job Syncline, where it cuts through the Greenbrier Limestone and ends with the Chemung Series at the axis of the Horton Anticline on the top of Allegheny Mountain.

Cross-Section B—B′.—Cross-Section B—B′ begins at the Randolph-Pocahontas County line on Back Allegheny Mountain two miles west of Durbin and extends southeast, roughly paralleling the Staunton and Parkersburg Pike, for a distance of 10.8 miles to the Virginia line on Allegheny Mountain. This section also begins in the Pottsville Series, quickly descending to the Hendricks Sandstone of the Chemung Series at the Greenbrier River at Durbin. From this river it continues across the folded Chemung Series to a point within 2 miles of the Virginia line, where the top of Allegheny Mountain is capped by the Catskill Series, and it then continues in the latter series to the State line.

Cross-Section C—C′.—Cross-Section C—C′ approximately 12 miles long, begins near the highest point in the county, Bald Knob on Back Allegheny Mountain, and extends southeast across the Greenbrier River near Wanless Station and continues on through Green Bank to the Virginia line. This section also begins in the Pottsville Series and quickly descends the escarpment to the Catskill Series at the Greenbrier River. From this river it continues southeast across the northern end of the plunging Huntersville Anticline at Green Bank into the Devonian shales and continues in them to a point within ¼ mile of the State line where the synclinal Allegheny Mountain is capped by the Pocono.

Cross-Section D—D′.—Cross-Section D—D′ starts two miles northwest of Clover Lick and extends southeast for a distance of 13.2 miles across the Greenbrier River, Thorny Creek Mountain, Michael Mountain, and ends at the Virginia line at Paddy Knob on Allegheny Mountain. This section begins in the lower members of the Mauch Chunk Series and descends to the Catskill Series at Clover Lick and continues in this series to the top of Thorny Creek Mountain. From there it continues across the series in descending order to reach the White Medina quartzite that makes the backbone of Michael Mountain and from this locality in reverse order to Paddy Knob on top of Allegheny Mountain capped by the Pocono Series.

Cross-Section E—E′.—Cross-Section E—E′ starts on Spruce Flats three miles northwest of Marlinton and contiues southeast at right angles to the strike, passing Marlinton at the junction of Knapp Creek with the Greenbrier River, and from this point it roughly parallels the Knapp Creek gorge to Minnehaha Springs, and on to the State line on Allegheny Mountain one mile north of Rimel.

This section not only shows exposures of the oldest rocks in the county, but also the largest continuous column. Along the State road from Marlinton to a point one mile southeast of Huntersville a geologic section of over 9,000 feet of strata can be seen, or from the Pocono to the Red Medina at the latter place.

In order to illustrate the amount of folding that has taken place in the Medinas from the bridge one mile east of Huntersville to Minnehaha Springs a special cross-section was prepared on a larger scale and can be seen in the text at Figure 17, page 272.

Cross-Section F—F′.—Cross-Section F—F′ starts at the State highway on Droop Mountain and continues southeast at right angles to the strike for a distance of ten miles to the Greenbrier County line at the crest of Beaver Lick Mountain. This section starts with the Droop Sandstone of the Mauch Chunk Series, which caps Droop Mountain, and descends in the geologic column in logical order to the White Medina Sandstone, making the crest of Beaver Lick Mountain.

DETAILED STRUCTURE.

GENERAL FEATURES.

As pointed out in earlier paragraphs, that region lying west of the Greenbrier River is a part of a broad monocline, in which minor structural relief has occurred in the form of gentle and rather symmetrical folds, of comparatively slight disturbance. It is a continuation, and marks the eastern limit, of similar conditions that prevail from the Appalachian Geosyncline in the western part of the State southeastward to the territory where the main Allegheny Ridges begin. Throughout this entire region, representing the remainder of the State west of the main folds, the strata have remained nearly horizontal, due in part to the distance from the force of the lateral thrusts and to the competency of the included strata. There are many massive sandstones of great compressive strength in the Pennsylvanian Rocks that outcrop for many miles as well as the Pocono and Greenbrier Series that are also very resistant.

East of the Greenbrier River severe folding has occurred in the Devonian and underlying Silurian Rocks. Although the less competent Devonian rocks have been severely mashed and squeezed, the same is true with the underlying rocks down to and including the competent Medinas, the oldest rocks exposed in the county, giving evidence that the great forces were no respecters of series. It is the writer's belief that the extent of folding is due to the proximity of the force that caused the lateral thrusts. The extensive folding in this area has brought to the tops of Beaver Lick-Browns-Michael Mountain the lower Silurian Rocks, which lie thousands of feet below the surface in the region to the west, and the Mississippian and Pennsylvanian strata are absent. That these younger strata once covered this area is most logical as their present eastern boundaries show considerable thickness, leaving little doubt that their eastern borders have been eroded away.

The causes for this tremendous folding have long been a topic of discussion, with no definite conclusions agreed upon. The writer does not accede to the conclusions of Keith[10] that the Appalachian folding is due to great batholith intrusions, but believes it is the result of the shrinking of the earth's crust due to cooling, followed by shifting of vast areas of sediments by erosion, ever attempting to retain a constant equilibrium, and that these batholith intrusions are a resultant of the mountain making rather than a cause.

UNCONFORMITIES.

Under the two general classes of unconformity, that is Non-conformity where the two formations are visibly different, and Disconformity where the two formations are in parallel position, that are found in Pocahontas County, those of the latter type are most common while at least one example of the former is present as a non-conformity.

In the descending rock column of Pocahontas County the first important break in the succession is found at the contact of the Pottsville Series of the Pennsylvanian with the underlying Mauch Chunk Series of the Mississippian. It is true that good exposures of this contact are not to be seen at the present time within the area of this report but it is

[10]Arthur Keith, Outlines of Appalachian Structure, Bull. Geol. Soc. of Am., Vol. 34, pp. 309-380; June, 1923.

evident that the coarse and conglomeratic sandstones of the Pottsville rest upon the red and green shales and green, flaggy and micaceous sandstones of the Mauch Chunk that are almost devoid of coals and lack the typical Upper Carboniferous flora. Such a condition would indicate an entirely different mode of accumulation, with occasional stages of emergence and subsequent erosion. Other than the resultant low areas which were later filled by lenses of the Pottsville, there is no apparent contrast in the dip of the beds, indicating a gradual, even subsidence with no perceptible folding during the lapse of time between the deposition of the Mauch Chunk and Pottsville Series. The northward convergence of these beds with a general thinning of both series in this direction is the normal development of a transgressing sea. A further and what is probably the most important difference between the two series is the presence of numerous marine fauna throughout the Mauch Chunk in contrast with their almost total absence from the overlying Pottsville Series.

During Mauch Chunk time another disconformity of at least minor importance is found where the Princeton Conglomerate rests upon the red shales of the Hinton Group. The character of the Princeton Conglomerate, although it extends over a considerable area, indicates a subsidence followed by a rapid deposition of large and small gravel interspersed with coarse sand and mud with occasional fragments of plants.

At the end of Greenbrier time and the beginning of Mauch Chunk time no abrupt change of character is noted in Pocahontas County. It is true the massive, rather pure limestones of the Greenbrier offer a distinct contrast between the overlying red and green shales of the Mauch Chunk, but the change from one to the other is gradual, with the thin platy limestones of the Glenray and Reynolds containing many of the same marine fauna found in the underlying series. Along its northern extension in West Virginia, however, and even in adjoining States, this gradual transition does not generally prevail, there being a distinct change from massive limestones to red shales.

At the base of the Greenbrier Series another disconformity is evident. In general the massive limestone rests upon the Maccrady Series the red shales of which are devoid of fossils, and which vary in thickness from 20 feet at the northern end of the county to 50 feet at its southern end, with an occasional exposure to be seen where the limestone rests upon the Pocono Series, indicating slight erosional depressions, filled with an impure argillaceous limestone that is correlated with the Warsaw. This will be discussed more in detail under the description of the Maccrady Series.

At the base of the Pocono Series which is also the base of the Mississippian throughout West Virginia, there is a disconformity of such magnitude that it might be called a non-conformity. The Catskill Series, which is composed of red and green shales and sandstones, characteristic of the Upper Devonian throughout northern West Virginia, Maryland, Pennsylvania, and New York, has decreased to some 800 feet in thickness in Pocahontas County with further thinning to the southwest and entire disappearance somewhere in Greenbrier County. Farther south the Pocono rests directly upon the Chemung Series with little evidence of any angular change in dip. It is highly possible that it was under some such condition as this that the Chemung fauna, which seems to be almost entirely absent from the Catskill Series, was permitted to survive and extend into the Pocono Series. It was along the Chesapeake and Ohio Railway at the mouth of Stevens Hole Run that a slight angular unconformity is evident.

There is a general thinning of the Devonian to the southwest as far as Tennessee where it is almost if not entirely absent. In Pocahontas County the Chemung, Portage, and Genesee retain at least their average thickness while the Hamilton is almost entirely absent. The Ridgeley Sandstone member of the Oriskany Series has thinned to some 50 feet with an overlying chert formation of some 60 feet that does not occur in the northern counties of the State. The underlying Shriver Chert of the same series and the New Scotland Chert of the Helderberg Series are also absent.

Beneath the Helderberg Series which is the basal member of the Devonian Period there is a well-defined faunal break.

The underlying Silurian Period, although somewhat attenuated, retains in general its characteristic form with the exception of the complete absence of the Bloomsburg Red Shale. In the lower Silurian rocks the White Medina (Tuscarora, Clinch) Series is still much in evidence as well as the underlying Red Medina (Juniata) Series. At this latter contact an excellent opportunity for study is offered at the large arch of the Browns Mountain Anticline just east of Huntersville. Here the sediments reveal more of a gradual transition from the underlying reds into the White Medina than any other exposure of which the writer has knowledge. See Plate XLIV. This contact will be discussed further under the Stratigraphy of this period.

FAULTS.

No evidence of major faulting was found in the area of this report. In the complex folded area comprising the Browns Mountain Anticline, disturbances were sufficient to produce some minor faults, but not of sufficient magnitude to be drawn on the geologic map. These are most pronounced along the State road east of Dunmore where much of the original bedding structure has been destroyed. Along the State road east of Huntersville the absence of ordinary development of the Silurian Limestone led to the belief that some displacement of the latter might have occurred. Farther south along the west side of Beaver Lick Mountain the same condition prevails. The massive White Medina Sandstone shows evidence of being heated sufficiently to induce recrystallization, brought about by heat generated within itself from strains and stresses during the mountain folding.

CHAPTER V.

MEASURED SECTIONS.

INTRODUCTION.

The surface or outcropping rocks of Pocahontas County include the Quaternary, with Recent and Pleistocene deposits, and a considerable portion of the Paleozoic, including the lower portion of the Pennsylvanian, the Mississippian, the Devonian, and the greater part of the Silurian sediments. A classification of these beds, approximating 13,535 feet of rocks, is shown in Figure 4, on pages 71-73.

The Quaternary Rocks are represented by clays, gravels, and sand beds, present along the river and creek valleys, and by river-terrace deposits of considerable quantity now resting many feet above the present streams. (See table of stream terraces). Some of these terraces are undoubtedly of Pleistocene age, although there is no evidence of glacial origin. These two types of formations, which make up the best farming lands along the larger streams, are represented on Map II under Alluvium. Terrace deposits have been discussed on pages 25-27.

The Kanawha and New River Groups of the Pottsville Series of the Pennsylvanian are the youngest of the Paleozoic rocks present, and they undoubtedly once covered Pocahontas County, as it is inconceivable that approximately 1,000 feet of strata would completely disappear in a distance of some twenty-five miles. They are now confined to the area west of the Greenbrier River, their supposed extension to the east having been removed by erosion.

The Mauch Chunk Series of the Mississippian is subdivided into four groups, Bluestone, Princeton, Hinton, and Bluefield, and contains approximately 1,800 feet of sediments, constituting a considerable portion of the surface of Pocahontas County west of the Greenbrier River.

The Greenbrier Series of the Mississippian contains about 600 feet of rocks that are predominantly calcareous. Its best exposures are found in a belt immediately west of the Greenbrier River. The new road cuts along the Seneca Trail (State Route 24) afford many clean exposures that offer excellent opportunity for study.

The outcrop of the Maccrady Series of the Mississippian is found immediately beneath the Greenbrier Series. It is found in a narrow belt west of the Greenbrier River the entire length of the county, from Greenbrier on the south to Randolph on the north, with one exposure at Blister Swamp, east of the Greenbrier River. It varies in thickness from 20 feet at the northern end of the county to 70 feet at the Greenbrier-Pocahontas County line as compared to 700 feet or more at its type locality in Smyth County, Virginia.

The Pocono Series comprises the basal members of the Mississippian in Pocahontas County and is seen to its best advantage west of the Greenbrier River in sections made from the river up to the series of flats that are so conspicuous along its entire length throughout the county. This series decreases in thickness from approximately 600 feet, at its best development in this area, to some 60 feet, west of Durbin.

The Devonian outcrops in Pocahontas County are confined to the area east of the Greenbrier River, with the exception of the Catskill Series which often outcrops along the river and occasionally west of it. The entire assemblage has a thickness of approximately 7,775 feet as compared to 11,000 feet in northeastern West Virginia. The Chemung Series retains a good development throughout the county and may be seen in its entirety along the State road east of Marlinton. The remaining series are all retained in this area but the Hamilton is greatly attenuated.

The Silurian rocks comprise the oldest sediments exposed in the county and are limited to the region east of the Greenbrier River along Beaver Lick, Brushy, Browns, and Michael Mountains. Their maximum thickness is approximately 2,200 feet.

In the area west of the Greenbrier River the gently dipping beds permit the measurement of numerous vertical sections, and the study in detail of the character of the surface rocks, while east of this area where the rocks are steeply dipping, additional sections have been obtained along streams and road cuts, where it was possible to determine approximately the vertical thicknesses by trigonometric computation. All of these sections appear in the following pages.

In the measurement of these sections numerous fossil collections were made and reference is often shown in parenthesis by lot number, referring to the particular zone described. These collections have all been examined by Dr. John L. Tilton and the results of his examination are published as Chapter XV, Notes on Paleontology.

Additional fossil collections were made by Dr. David White, David B. Reger, and the writer with particular emphasis on the fossil flora, but the results of these collections will not be available for this report. They will, however, probably be included in a later volume embracing a wider territory than Pocahontas County.

MEASURED SECTIONS, EDRAY DISTRICT.

Edray District occupies the area west of and bordering the Greenbrier River between Violet and Raywood on the east and from Mace to the divide between Middle Fork and the main Williams River on the west. Its surface rocks range from the Kanawha Group of the Pottsville down nearly to the base of the Catskill Series. This area offers exposures that have been but slightly disturbed, some of which are along the new State road, in which recent cuts offer good exposures for study.

The following section, measured by the writer, includes a cross-section of the beds from the basal Pottsville Series nearly to the base of the Pocono Series, and offers a complete exposure of the Greenbrier Limestone. Certain exposures not visible along the line of traverse are inserted from an unpublished section measured by Reger slightly farther east:

Edray Section.

Edray District: starting on the high point on Red Lick Mountain, 2.5 miles northwest of Edray and traversing southeastward along the slope of the summit on the State road, thence almost directly south along the new State road to the intersection with the old road ½ mile south of Edray, thence offsetting southward 1 mile, to the point where the new road leaves the old road to Stony Creek at Campbelltown; measured partly with aneroid and partly with hand-level.

	Thickness. Feet.	Total. Feet.
Pottsville Series—New River Group (150')		
1. Partly concealed but top bluff is made of brownish-white conglomerate which weathers white	150	150
Mauch Chunk Series—Bluestone Group (110')		
2. Concealed	25	175
3. Sandstone, light-brown, coarse-grained, weathers white; loose fragments with white quartz pebbles	25	200
4. Concealed	60	260
Mauch Chunk Series—Princeton Conglomerate (70')		
5. **Sandstone, Princeton Conglomerate,** light-brown, coarse-grained, cross-bedded, no pebbles seen	70	330
Mauch Chunk Series—Hinton Group (545')		
6. Shale, mostly concealed but some reds exposed	285	615
7. **Sandstone, Goodwyn,** red, shaly	10	625
8. Shale, partly concealed and partly red	220	845
9. **Sandstone, Stony Gap,** reddish-green, makes bench at house	30	875
Mauch Chunk Series—Bluefield Group (731')		
10. Shale, partly concealed but mostly red or occasionally green, to road summit (3539' L.)	200	1075
11. **Sandstone, Big Spruce Knob,** gray, hard, platy	15	1090
12. Shale, red and greenish	15	1105
13. **Sandstone, Bertha,** gray or green, lenticular, but partly massive	20	1125
14. **Shale, Upper Bertha,** red, brown, sandy shales, lenticular	45	1170
15. **Coal,** lenticular, with plant fossils	0	1170
16. **Shale, Lower Bertha,** red or brown, sandy	20	1190
17. **Sandstone, Bradshaw,** green or brown, uneven-textured, shaly	40	1230
18. **Coal, Red Sulphur,** with abundant **Calamites,** and a few marine fossils	0	1230
19. **Shale, Bradshaw,** red and variegated	30	1260
20. **Sandstone, Indian Mills,** red and brown, with 10' of brown sandy shales near middle	30	1290
21. Shale, red 40' 0"; 22. Shale, bluish-gray and red, fossiliferous zone 1 6; 23. Shale and sandstone; scattered fossil pits 20 6; 24. Shale, red, green, sandy 20 0 — **Indian Mills Shale**	82	1372

			Thickness. Feet.	Total. Feet.
25. Coal, Raines Corner, streak; plant fossils			0½	1372½
26. Shale, red, yellow, green and sandy			45½	1418
27. Shale, Ada, green, sandy			25	1443
28. Shale, variegated; marine fossils near base			10	1453
29. Limestone, with blue and gray calcareous shale, with abundant marine fossils, Orthotetes, Productus, etc.	10′			
30. Limestone, grayish-blue, weathers yellow, (Lot 9)	10	Reynolds Limestone	30	1483
30A. Limestone, thin, with gray shales; abundant fossils, Composita, Productus, Orthotetes, etc.	10			
31. Shale, Bickett, red and green			50	1533
32. Limestone, hard, impure, siliceous, fossiliferous	5′ 0″			
33. Shale, red and yellow, with thin limestone (Lot 18)	8 0	Glenray Limestone	14½	1547½
34. Limestone, siliceous, fossiliferous	1 6			
35. Shale, gray, green, sandy	20′ 6″			
36. Sandstone, Edray, flaggy and shaly, (From Reger's Edray Section 1 mi. N. of Edray) 25′ to	0 0			
37. Limestone, earthy, very fossiliferous, bryozoa, Fenestella, crinoids	2 6	Lillydale Shale	58½	1606
38. Shale, gray, green, sandy, stained brown with iron	35 6			
Greenbrier Series (407′)				
39. Concealed			10	1616
40. Limestone, Alderson, dark-blue, irregularly fractured, with abundant Pentremites, also Chonetes and a trilobite. (Lot 19)			20	1636
41. Limestone, with red, calcareous shales, fossiliferous			5	1641
42. Limestone, gray; streaks of oolite, crinoids			20	1661
43. Shale, Greenville, dark-brown, crumbly, calcareous; abundant fossils (Lot 8)			20	1681
44. Limestone, impure, shaly; abundant fossils, Chonetes, Productus, corals, etc. (Lot 7)			12	1693
45. Limestone, dark, impure			8	1701
46. Limestone, dark-blue, with a few scattered brachiopods			12	1713
47. Concealed			10	1723

		Member	Thickness. Feet.	Total. Feet.
48. Oolite, grayish-blue....	6′			
49. Limestone, grayish-blue	9			
50. Limestone, dark-blue...	10			
51. Limestone, grayish-blue; abundant fossils, crinoids, brachiopods, bryozoa........	15			
52. Oolite, fossiliferous....	8	Union Limestone..	83	1806
53. Limestone, dark-blue, massive	10			
54. Limestone, gray, fossiliferous, with 6′ oolite.	15			
55. Limestone, dark-blue, massive, brittle, weathers white; crinoids..	10			
56. Limestone, dark-blue, impure, weathers yellow, with top shaly; crinoids	14′			
57. Shale, yellow, calcareous	5			
58. Shale, red, sandy......	4	Pickaway Limestone	39	1845
59. Limestone, impure, sandy, streaked with red	5			
60. Limestone, massive, impure, fossiliferous....	8			
61. Shale, red, calcareous..	3			
62. Limestone, sandy, fossiliferous...............			10	1855
63. Limestone, dark-blue, hackly, weathering yellow; brachiopods, crinoids, fenestelloids....			4	1859
64. Oolite, fossiliferous; many crinoid stems.....			4	1863
65. Limestone, dark-blue weathering yellow, massive; fossils scattered throughout..........			30	1893
66. Concealed			15	1908
67. Shale, red, with 2 streaks of oolite..............	8′			
68. Oolite, gray............	4			
69. Shale, red..............	1			
70. Limestone, impure, cobbly	3	Taggard Limestone	24	1932
71. Limestone, impure, streaked with red....	8			
72. Concealed			10	1942
73. Limestone, Patton, massive, fossiliferous, mostly oolitic, good for building stone...........			20	1962
74. Limestone, dark-blue, fossiliferous, with parallel dark bands..............................			12	1974
75. Limestone, dark, oolitic......................			1	1975
76. Limestone, dark-blue, fossiliferous............			17	1992
77. Limestone, oolitic, fossiliferous...............			1	1993
78. Limestone, dark-blue, massive; brachiopods, crinoids, etc...............................			10	2003
79. Concealed, Hillsdale Limestone horizon, (St. Louis age as correlated in Kentucky), dark, with chert. From Reger's Edray Section, 1 mi. north of Edray (40′)...................			10	2013

		Thickness. Feet.	Total. Feet.
Maccrady Series (30′)			
80. Shale, red, with 18″ of red sandstone (exposed at road fork, ½ mi. south of Edray)........		30	2043
Pocono Series (253′+)			
81. Sandstone, brown, soft, shaly .... 25′	Broad Ford Sandstone	63	2106
82. Sandstone, brown, irregular, with concretionary weathering; streaks of conglomerate 10			
83. Sandstone and shale, brown 5			
84. Sandstone, brown, massive, with quartz pebbles 5			
85. Shale, brown.......... 3			
86. Sandstone, gray or green; marine fossils, gastropods, Productus, etc.............. 7			
87. Conglomerate, with pebbles from size of sand grains to 1″ in diameter 2			
88. Sandstone, massive, ferruginous 6			
89. Concealed		10	2116
90. Clay, whitish................................		1½	2117½
91. Sandstone, brown, shaly, stained with iron....		4½	2122
92. Shales, light, sandy.........................		8	2130
93. Sandstone, yellowish-brown, massive..........		15	2145
94. Shale, variegated, soft, sandy.................		22	2167
95. Sandstone and shale, gray, hard..............		31	2198
96. Shale and sandstone, dark and variegated, alternating with gray-green sandstones, 1″ to 24″.......................................		53	2251
97. Shale, variegated, alternating with 1″ to 6″ yellowish-brown sandstones.................		25	2276
98. Concealed to bridge at Campbelltown..........		20	2296

The following section, measured by the writer, affords the best example for detailed study of the Pocono Series in Pocahontas County. The base of the series, however, which is below drainage here, is computed with relative accuracy from the Alexander water wells in Marlinton:

Kee Flats Section.

Edray District; starting on Kee Flats 1 mile southwest of Marlinton and traversing northward along the cut made by new State road to the Greenbrier River. Adding the depth to the Berea Sand in the Alexander water wells gives a complete thickness of the Pocono.

The water sand in the Alexander wells was struck at approximately 100 feet, or 85 feet below the river where the hand-level section stopped. Kee Flats is now mostly Pocono with small areas of red Maccrady shales. Section measured by hand-level to Greenbrier River.

			Thickness. Feet.	Total. Feet.
Maccrady Series				
1. Red shales—not measured, base 2475′ B.				
Pocono Series (450′)				
2. Sandstone, platy, gray and brown sandstone alternating with gray and dark sandy shales..			60	60
3. Sandstone, gray, massive, cross-bedded....	10′			
4. Ferruginous quartz conglomerate	1			
5. Sandstone, gray and brown, massive; stained brown with iron, and weathering into large concentric boulders	14			
6. Fossil zone — abundant (Lots 10 and 22).....	1½			
7. Sandstone, gray-green, massive	8			
8. Fossil zone............	1½			
9. Sandstone, green and brown, massive......	14	Broad Ford Sandstone	80	140
10. Shales, green, gray, brown, sandy........	16			
11. Conglomerate, ferruginous; quartz pebbles	0½			
12. Shales, variegated.....	3			
13. Sandstone, blue-gray, massive, fine-grained, with quartz pebbles..	9			
14. Conglomerate, ferruginous, with quartz pebbles	1½			
15. Shales, variegated, sandy......................			10	150
16. Sandstone, gray, green and brown, and shales with streaks of red........................			25	175
17. Shales, (0′ 3″), carbonaceous, coal horizon? (2300′ B.)..................................			..	175
18. Sandstone, (19′ 9″), thin, with variegated sandy shales			20	195
19. Shales, blue, sandy, alternating with flags of gray sandstone 1″ to 3″ thick.....................			30	225
20. Shale, green and brown, sandy, alternating with grayish-green sandstones 1″ to 10″ thick......			50	275
21. Concealed to Berea Sandstone (2025′), computed from Alexander water wells.................			175	450

The following section was measured by the writer primarily to show the relation of the Pocono Series to the Greenbrier Series. A complete exposure here shows the

Maccrady red shale to be entirely absent, but replaced by a blue and gray calcareous shale with a peculiar development of geodes, which the writer is correlating as the Warsaw Member of the Maccrady Series. A further discussion will be found under the stratigraphy of the Maccrady Series:

McLaughlin Springs Section.

Edray District; three-fourths mile west of Edray at the McLaughlin Springs.

		Thickness. Feet.	Total. Feet.
Greenbrier Series (25′+)			
1. Limestone, Hillsdale, cherty		25	25
Maccrady Series—Warsaw Member (23′)			
2. Limestone, light-gray, argillaceous; has appearance of soapstone		9	34
3. Shale, bluish, calcareous		3	37
4. Geodes, 3″ layer of calcareous geodes		..	37
5. Shale, (10′ 9″), bluish-green, calcareous, disintegrates readily		11	48
Pocono Series (50′+)			
6. Sandstone, bluish or olive-gray, shaly		10	58
7. Sandstone, bluish-gray, fine-grained, micaceous ... 25′ 8. Sandstone, grayish-green, with red and white quartz pebbles; also limestone pebbles and clay balls; quartz pebbles from grains to 1″ in diameter ... 5 9. Sandstone, bluish-brown, fine-grained ... 10	Broad Ford	40+	98
10. Concealed		....	..

The following section, measured by the writer, is a detailed section of the Catskill from its top down to the Greenbrier River at Sitlington:

Sitlington Section.

Edray District; starting 1 mile northwest of Sitlington and traversing southwestward along road to Greenbrier River at Sitlington; section measured with aneroid at right angles to the strike.

	Thickness. Feet.	Total. Feet.
Pocono-Catskill Contact (2750′ B.)		
Catskill Series (400′)		
1. Shales, red	80	80
2. Sandstone, red	5	85
3. Shales, red, sandy	10	95

	Thickness. Feet.	Total. Feet.
4. Sandstone, red and brown, gray at base, cross-bedded	25	120
5. Concealed	10	130
6. Sandstone, irregular, cross-bedded	5	135
7. Shales, red, brown and green	30	165
8. Shales, red	10	175
9. Sandstone, gray, brown; weathers white	5	180
10. Shales, red, sandy, with occasional thin brown sandstones	120	300
11. Sandstone, brownish-white, fine-grained; weathers white	10	310
12. Concealed to bridge at Sitlington, Hendricks Sandstone horizon (2360′ B.)	90	400

The following section, measured by the writer, is composed mainly of the Mauch Chunk Series as contrasted to that of the Edray Section. Its somewhat abbreviated thickness is due in part to the rise of the beds to the southeast:

Props Run Section.

Edray District; beginning at a high point on Gauley Mountain 2 miles northwest of Slaty Fork at the head of Props Run and traversing eastward to lumber railroad grade of W. Va. Pulp and Paper Company, thence along this grade to Elk River at Slaty Fork.

	Thickness. Feet.	Total. Feet.
Pottsville Series—Kanawha and New River Groups (640′)		
1. Sandstone, white, massive, coarse-grained, with white quartz pebbles	40	40
2. Concealed, with heavy conglomerate talus, to base of Pottsville	600	640
Mauch Chunk Series—Bluestone Group (100′)		
3. Shale, red and green	100	740
Mauch Chunk Series—Princeton Group (50′)		
4. Sandstone, Princeton, grayish-brown, coarse-grained; profuse quartz pebbles	50	790
Mauch Chunk Series—Hinton and Bluefield Groups (1020′)		
5. Shale, red	190	980
6. Concealed	285	1265
7. Shale, red	15	1280
8. Concealed	70	1350
9. Sandstone, massive, reddish, coarse-grained	45	1395
10. Shale, red, sandy	20	1415
11. Sandstone, red and green; makes falls	5	1420
12. Shale, red (on Props Run)	25	1445
13. Concealed	160	1605
14. Shale, red, alternating with 3′ sandstones	15	1620
15. Shale, red	25	1645
16. Shale, red and green, arenaceous	15	1660
17. Concealed (terrace gravel at 2710′ B.)	100	1760
18. Sandstone, Edray, fine-grained, micaceous, with specks of iron and inclusions of shale	50	1810

The following section not previously published, was measured by David B. Reger, and remeasured by the writer with slight alterations:

Slaty Fork Section.

Edray District; starting at the top of Gauley Mountain 2.8 miles southwest of Slaty Fork and extending northwestward down Flat Ridge of this mountain to Slaty Fork village; gentle northwest dip; measured with aneroid along the strike by David B. Reger and arranged in descending stratigraphic order.

	Thickness. Feet.	Total. Feet.
Pottsville Series—New River Group (500')		
1. Interval from top of mountain, with sandstone, concealed, shale, etc., not examined	312	312
2. Slate, black, thickness not recorded	..	312
3. Coal, medium-soft... 5' 1"; 4. Concealed, with streak of coal reported ... 7 0; 5. Coal ... 1 0 — (13' 1" Sewell (Sharon) (4225' B.) Cherry River Boom & Lumber Company Prospect (No. 16 on Map II)	13	325
6. Concealed	125	450
7. Sandstone, Upper Raleigh (Sharon); visible near old trail at head of Laurel Run (4050' B.)	50	500
Mauch Chunk Series—Bluefield Group (815')		
8. Shale, red, partly concealed	100	600
Mauch Chunk Series—Princeton Conglomerate (50')		
9. Sandstone, Princeton, massive, pebbly, great conglomerate (3900' B.)	50	650
Mauch Chunk Series—Hinton Group (415')		
10. Concealed	90	740
11. Shale, red, partly concealed	275	1015
12. Sandstone, Stony Gap, brown, massive, medium-coarse, cliff; makes Nutter Flat (3485' B.)	50	1065
Mauch Chunk Series—Bluefield Group (815')		
13. Concealed, with sandstone, in steep bluff	153	1218
14. Sandstone, flaggy	2	1220
15. Concealed, mostly red shale	180	1400
16. Sandstone, Graham (Big Spruce Knob of Webster Report) (3120' B.)	30	1430
17. Concealed	410	1840
18. Sandstone, Edray, shaly, reported at Slaty Fork Post-Office by Paul H. Price	40	1880
Greenbrier Series (10'+)		
19. Limestone, to Elk River at Slaty Fork (2660' B.)	10	1890

The following section, measured by the writer, with a proper correction for the northwestward dip, is exposed along the road to Williams River by way of Onoto:

Onoto Section.

Edray District; starting at Woodrow (B. M. 3210') on the divide between the waters of Stony Creek and Laurel Creek about four miles west of Onoto and traversing along the road to Onoto. The Warsaw Member of the Maccrady Series was seen at the big springs just east of the concrete bridge that crosses the stream made by these springs. Measurement by aneriod (100 feet added to Greenbrier Series, Nos. 7-14, as a correction for dip).

	Thickness. Feet.	Total. Feet.
Mauch Chunk Series—Bluefield Group (280′)		
1. Sandstone, Droop, brown, massive; weathers to white sand	25	25
2. Shale, mostly concealed but occasionally red and green	105	130
3. Limestone, Reynolds, dark, shaly, with many fossils, Spirifer, Orthotetes, Composita, crinoids..	15	145
4. Shale, red and green	100	245
5. Sandstone, Edray, light-brown	20	265
6. Shale, green	15	280
Greenbrier Series (500′)		
7. Limestone, Alderson, dark-gray, impure, fossiliferous, lower part concealed	25	305
8. Concealed (Greenville Shale and Union Limestone interval)	185	490
9. Limestone, Pickaway, dark, massive, not all exposed	50	540
10. Concealed	100	640
11. Limestone, Taggard, gray, oolitic, with streaks of red shales	15	655
12. Limestone, Patton, gray, shaly at top, with good oolite at base	100	755
13. Limestone, Hillsdale, dark-gray, fossiliferous, with nodules of black chert	25	780
Maccrady Series (20′)		
14. Shale, gray or blue, earthy, calcareous, Warsaw Member; reds seem to be absent here	20	800
Pocono Series (41′+)		
15. Sandstone, brown...... 20′ 16. Conglomerate .... 1 17. Sandstone, brown or green, with conchoidal weathering....... 20 } Broad Ford Sandstone	41	841

The following section, measured by the writer in company with D. L. Beverage of Stony Bottom, is of prime importance with reference to the extension of the Cheat Mountain Coal Field. Good exposures of the key-horizons were found throughout, affording a section from the basal Pottsville down to and including the upper portion of the Catskill Series at Stony Bottom:

Elklick Run Section.

Edray District; starting at the U. S. G. S. triangulation station at Thorny Flat on the southern end of Cheat and Back Allegheny Mountains and continuing southward along Elklick Run to Stony Bottom; measurement by aneroid.

	Thickness. Feet.	Total. Feet.
Pottsville Series—New River Group (100′)		
1. Sandstone, Upper Raleigh, (Sharon), weathered and broken, gray and white sandstone with some white quartz pebbles; base concealed...	40	40
2. Concealed. Heavy sandstone talus, weathered white	60	100
Mauch Chunk Series—Bluestone Group (100′)		
3. Concealed	100	200
Mauch Chunk Series—Princeton Conglomerate (50′)		
4. Sandstone, Princeton, gray, brown and white with quartz pebbles from size of sand grains to a few inches in diameter; some sandstone pebbles..	50	250
Mauch Chunk Series—Hinton Group (535′)		
5. Concealed	285	535
6. Sandstone, gray or brown, massive	20	555
7. Concealed	50	605
8. Shale, Upper Goodwyn, brown, yellow, sandy....	10	615
9. Coal, Goodwyn, clean (0′ 4″)	..	615
10. Shale, Lower Goodwyn (9′ 8″), gray and dark, with marine fossils, particularly pelecypods. (Lot 60 at elevation 4200′ B.)	10	625
11. Concealed and red shale	140	765
12. Sandstone, Stony Gap, gray or brown, cross-bedded; makes large flat at low gap	20	785
Mauch Chunk Series—Bluefield Group (740′)		
13. Concealed and red shale with thin sandstone...	690	1475
14. Limestone, Reynolds, impure, and fossiliferous; exposed	15	1490
15. Concealed and brown shale	35	1525
Greenbrier Series (510′)		
16. Limestone. No attempt to subdivide	510	2035
Maccrady Series (30′)		
17. Shale, red, and concealed	30	2065
Pocono Series (210′)		
18. Concealed, mostly, with some brown flaggy sandstone	190	2255
19. Sandstone, Berea, brown, massive, with quartz pebbles	20	2275
Catskill Series (70′+)		
20. Concealed	20	2295
21. Sandstone, massive, gray, brown, and red, with red shale; good exposure along C. & O. Ry. cut ¼ mile south of Stony Bottom (2320′ B.).....	50	2345

The following section, measured by Reger[1], has several points of interest because it shows the rapid rise of the strata to the east, as the Sewell and Hughes Ferry Coals found in Black Mountain would be above what is now the top of Big Spruce Knob, thus precluding the possibility of any coal of minable thickness being found east of this knob. Furthermore the supposed presence of a 4′ 10″ coal in the Bluefield

[1]David B. Reger, Webster County Report, W. Va. Geol. Sur., pp. 122-4; 1920.

Group of the Mauch Chunk Series is very unusual. It is the writer's opinion that if such a thickness was measured it was a local development in the form of a lens and would not extend for any distance, as the same horizon was seen at other localities with clean exposures and a coal of no such thickness was found. This section gives valuable information regarding the oil sands in this locality and furnishes a complete vertical measurement of the Mauch Chunk Series with a total thickness of 1877 feet. In the lower part of the well record certain changes suggested by Reger on the basis of vastly increased knowledge of the Pocono and Catskill Series have been incorporated:

Big Spruce Knob Section.

Edray District; starting at the top of Big Spruce Knob, west of Marlinton, descending southwestward to Williams River and connecting with the record of the Pocahontas Coal and Land Company No. 1 (1) oil test well on its land; surface portion measured with aneroid by David B. Reger and arranged in descending order; well record furnished by Mr. Hubert Echols, an official of the company.

	Thickness. Feet.	Total. Feet.
Pottsville Series—New River Group (40′)		
1. Sandstone, Upper Raleigh, (Sharon); massive, pebbly, caps Big Spruce Knob	40	40
Mauch Chunk Series—Bluestone Group (240′)		
2. Concealed and sandstone	150	190
3. Concealed, with reds	90	280
Mauch Chunk Series—Princeton Conglomerate (40′)		
4. Sandstone, Princeton, massive, cliff rock	40	320
Mauch Chunk Series—Hinton and Bluefield Groups (1597′)		
5. Concealed, with reds in steep slope	110	430
6. Bench	...	430
7. Concealed, with reds in steep slope	120	550
8. Bench	...	550
9. Shale, red, partly concealed	500	1050
10. Sandstone, Big Spruce Knob, green, flaggy	30	1080
11. Shale, Big Spruce Knob, gray, 2′ to	0	1080
12. Coal, Big Spruce Knob, (3615′ B.; fallen shut, reported 4′ 10″) (No. 18 on Map II)	5	1085
13. Concealed and sandstone to level of well	225	1310
Continued by Pocahontas County Coal and Land Company No. 1 (1) well (3390′ B.):		
14. Unrecorded	180	1490
15. Lime formation	50	1540
16. Unrecorded	377	1917
Greenbrier Series (546′)		
17. Big Lime	546	2463
Pocono Series (309′)		
18. Unrecorded	164	2627

	Thickness. Feet.	Total. Feet.
19. Sand, Weir, Broad Ford, (oil show?)	145	2772
Catskill Series (874′)		
20. Red rock	101	2873
21. Unrecorded	5	2878
22. Sand, Fifty-foot?	104	2982
23. Red rock	109	3091
24. Sand, Thirty-foot?, white	31	3122
25. Sand, Gordon Stray?, broken	146	3268
26. Shale	50	3318
27. Sand, Gordon, Fourth and Fifth?, good	245	3563
28. Slate	19	3582
29. Red rock	64	3646
Chemung Series (696′+)		
30. Sand, Hendricks?	36	3682
31. Slate	12	3694
32. Sand	60	3754
33. Slate	13	3767
34. Sand	85	3852
35. Slate and shell to bottom	490	4342

"Hole was drilled 10″ diameter for 120′; 8″ for 1520′; 6¼″ for balance; 660′ of 8″ casing being used. Hole was entirely free from water below casing. No salt water in well at all; a slight showing of oil was found in the upper sand, sufficient to grease the tools and bailer. All sand struck was very, very hard".

MEASURED SECTIONS, HUNTERSVILLE DISTRICT.

Huntersville District is situated in the southeastern part of the county and east of the Greenbrier River, comprising the entire drainage basin of Knapp Creek and the headwaters of Anthony Creek, Thomas Creek, and Shock Run, as well as Beaver Creek, Improvement Lick, Monday Lick, Sunday Lick, and Stillhouse Runs. Its surface rocks range from the Pocono down to and including the Red Medina Series.

The following long section, measured by the writer, is unique in many respects since it affords the longest continuous exposure in the county, so that by traversing the State road east from Marlinton along the Knapp Creek gorge to Minnehaha Springs a geologic section from the Berea Sandstone of the Pocono Series down to and including the Red Medina Series can be seen. The section has a total vertical thickness of 9,100 feet of rocks.

The section begins with the conglomeratic Berea Sandstone at the corporate limits and follows the State road along Knapp Creek. At 0.7 mile east of the starting point another conglomerate, coming approximately 200 feet below the

Berea, is well exposed. It was suggested by the late Dr. I. C. White, while on a visit in that county during the summer of 1927, that this conglomerate probably represented the Gordon Sand of the oil well drillers:

Knapp Creek Section.

Huntersville District; beginning with the Berea Sandstone at the corporate limits on the Marlinton-Huntersville road along Knapp Creek and traversing southeastward along this road to the Minnehaha Springs bridge; measured in descending order.

	Thickness. Feet.	Total. Feet.
Pocono Series (70′)		
1. **Sandstone, Berea,** white, massive, coarse-grained, with abundant quartz pebbles from size of sand grains to 2¼″ in diameter	15	15
2. Shale, light, yellowish-brown, with plants	20	35
3. Sandstone, gray, green and brown, fine-grained, flaggy	25	60
4. Shale, yellow, earthy	10	70
Catskill Series (655′)		
5. **Shale, Saxton,** green at top to gray-blue, micaceous; plant fragments	20	90
6. Concealed and red shale	75	165
7. Sandstone, greenish-brown	10	175
8. Shale, green and red	10	185
9. Sandstone, red and shaly	10	195
10. Shale, red	60	255
11. Sandstone, red, gray, irregular ... 10′ 12. Shale, variegated ... 5 13. Sandstone, gray to blue, concentric weathering, stained with iron. 30 14. **Conglomerate,** coarse-grained, with 18″ carbonaceous shale with plant stems near top, abundant quartz pebbles ... 30 } **Gordon Sand?**	75	330
15. Shale, partly concealed but mostly red	200	530
16. Sandstone, gray, green, red, irregularly bedded	25	555
17. Shale, red, sandy	50	605
18. Sandstone, red, micaceous, cross-bedded	20	625
19. Shale, variegated and sandy	100	725
Chemung Series (3185′)		
20. **Sandstone, Hendricks,** grayish-brown to white sand grains, with flattened quartz pebbles	18	743
21. Shale, brown, sandy	22	765
22. Sandstone, brown, fine-grained	5	770
23. Shale, brown, sandy	25	795
24. Concealed	825	1620
25. Sandstone, greenish-brown, platy and shaly, fossiliferous, (**Lot 52**)	20	1640
26. Concealed, with brown shale	30	1670

	Thickness. Feet.	Total. Feet.
27. **Sandstone, Elkins,** reddish-brown, fine-grained, **Atrypa hystrix** zone	15	1685
28. **Sandstone, Elkins** (continued), greenish to reddish-brown thick flagstone, fine-grained and alternating with brown sandy shale; heavier bedded at base; marine fossils along with tree trunks in horizontal position flattened on bottom and semicircular on underneath side	50	1735
28a. **Sandstone, Elkins,** (continued), somewhat shaly; numerous marine fossils	150	1885
28b. **Sandstone, Elkins,** (continued), blue-green on fresh fracture, but weathering brown; fine-grained; massive; contains large stump and portions of tree trunks	50	1935
29. Sandstone, brown, fine-grained, alternating with brown, sandy shale	275	2210
30. Sandstone, predominating, gray and brown, alternating with shale; heavier bedded sandstone near base. Lower portion contains sufficient marine shells to form layers of limestone. (**Lot 35) Atrypa hystrix, Spirifer disjunctus,** crinoid stems, bryozoa, etc	1700	3910
Portage Series (2410′)		
31. Sandstone and shale; grayish-green to grayish-brown, fine-grained, platy sandstones alternating with shales of same color; little change in lithologic character throughout; marine fossils; **Lot 1** was taken near middle	2410	6320
Genesee Series (150′)		
32. Shale, dark, hard, fissile, sandy, concealed along State road but can be seen along Browns Creek road about 1 mile north of forks	150	6470
Hamilton and Marcellus Series (600′)		
33. Concealed. The Hamilton if present, and most of the Marcellus, is concealed under the flood-plain of Knapp Creek. Black, argillaceous, squeezed shale (lower part of Marcellus) exposed at Huntersville	600	7070
Oriskany Series (100′)		
34. **Chert, Huntersville,** partly concealed but interval composed of 2″ to 4″ angular blocks of light weathered chert	60	7130
35. **Sandstone, Ridgeley,** poorly exposed but decomposed brown sandstone	40	7170
Salina Series (800′)		
36. Concealed .... 600′		
37. Limestone, impure, with ostracods; (**Lot 2**) 4		
38. Shale, dark 8		
39. Limestone, impure, gray, weathers yellow 2		
40. Shale, calcareous 3		
41. Concealed 158		
Helderberg, Bossardville, and Rondout Groups (36–41)	775	7945
42. **Sandstone, Bloomsburg?,** grayish-brown, quartzitic, 4″ to 18″ flaggy layers	25	7970

		Thickness. Feet.	Total. Feet.
Niagara Series (40')			
43. Shale, dark, but mostly concealed		40	8010
Clinton Series (501')			
44. Sandstone, thin-bedded, shaly	4'		
45. Sandstone, brown, quartzitic	8	Keefer 18	8028
46. Sandstone, brown, thin-bedded, shaly	6		
47. Shale, yellow and gray, thin-bedded, fossiliferous (Lot 3)		52	8080
48. Shale, variegated, with platy sandstones		30	8110
49. Shale, variegated, sandy, alternating with 1" to 6" limestone		12	8122
50. Iron ore, red, Fossil Ore Horizon (0' 7")		1	8123
51. Limestone, impure, siliceous		5	8128
52. Sandstone, dark, calcareous (23' 5")		23	8151
53. Shale, yellow and green, sandy, alternating with platy sandstones 1" to 3" thick, with occasional thin limestones		20	8171
54. Shale, mashed, yellowish-brown, fissile, estimated		200	8371
55. Sandstone and shale, red, Iron Sandstone; 1" to 2" layers alternating with variegated shales		50	8421
56. Shale, brown, sandy		20	8441
57. Sandstone, red, ferruginous, platy		10	8451
58. Shale and sandstone, variegated		60	8511
White Medina Series (188')			
59. Sandstone, gray, massive, quartzitic		6	8517
60. Sandstone, gray or brown, platy, 1" to 6" layers, alternating with dark sandy shales		24	8541
61. Sandstone, white, massive, quartzitic, with fucoids		12	8553
62. Sandstone, shaly		10	8563
63. Sandstone, massive, quartzitic		30	8593
64. Shale, dark and variegated		6	8599
65. Sandstone, massive, quartzitic	86' 10"		
White quartzite, fine pebbles 1' 2"			
Quartzite, abundant quartz pebbles 4 0	13 2	100	8699
Massive quartzite, pebbles sparse, except at base, with 3" iron sandstone conglomerate 8 0			
Red Medina Series (401')			
(The upper 18' 0" although recorded under the Red Medina Series are truly transitional).			
66. Sandstone, light, argillaceous	2' 6"		
67. Sandstone, greenish-brown, alternating with sandy shale	5 0		
68. Sandstone, reddish-brown, quartzitic	4 2	18	8717
69. Sandstone, light, shaly	1 8		
70. Shale, brownish-gray, sandy, with 1' of reddish sandstone	4 8		
71. Shale, red, alternating with red sandstone		383	9100
72. Concealed			

The following section, measured by the writer in company with Andrew Price of Marlinton, shows a peculiar development of beautifully colored laminated clays in the Helderberg Limestone Series. Two samples of these clays were collected for analysis the results of which appear as Samples Nos. 22 and 23:

Rainbow Run* Section.

Huntersville District; along Rainbow Run, one mile northeast of Browns Creek School; traverse eastward.

	Thickness. Feet.	Total. Feet.
Marcellus Series (120′ exposed)		
1. Shale, black, with large septarian nodules, Lower Selinsgrove Limestone	30	30
2. Concealed, Selinsgrove Shale horizon	90	120
Oriskany Series (130′)		
3. Chert, Huntersville, dark-gray, hard	55	175
4. Sandstone, brown, massive ... 10′; 5. Conglomerate, "wheat grain", small quartz pebbles about the size of rice or wheat grains ... 5; 6. Sandstone, earthy-brown, coarse-grained, with fossil pits ... 60 — Ridgeley	75	250
Helderberg Series (380′)		
7. Concealed	150	400
8. Clays, siliceous, finely laminated, all colors; see description of Helderberg Series	230	630
Salina Series—Bossardville Group (325′)		
9. Concealed	325	955
Salina Series—Rondout Group (100′)		
10. Limestone, light gray, platy and shaly	100	1055
Niagara Series (90′)		
11. Limestone, gray, thin, interbedded with shale	90	1145
Clinton Series (465′)		
12. Sandstone, grayish-brown quartzitic ... 5′; 13. Shale, dark, sandy ... 1; 14. Sandstone, shaly ... 9; 15. Sandstone, earthy ... 10 — Keefer	25	1170
16. Shale, yellow and brown, alternating with 8″ to 12″ of very fossiliferous limestone strata in upper portion (Lot 12)	300	1470
17. Sandstone, Iron, red, quartzitic and oolitic. Partly concealed in dip of ravine	40	1510
18. Concealed to White Medina	100	1610
White Medina Series (50′)		
19. Sandstone, white, quartzitic; makes arch	50	1660

*This stream was named by Andrew Price of Marlinton Rainbow Run because of the beautiful development of clays, having the appearance of a rainbow.

The following section, measured by the writer, affords an opportunity to study the relation between the Catskill Series and overlying Pocono Series. Here the Berea Sandstone rests directly upon the red shales. On a second visit to this locality in company with Dr. David White and David B. Reger, a slab of sandstone which was undoubtedly from the Saxton horizon, and which was matted with bony fish plates and conical fish teeth, was picked up. See Dr. John L. Tilton's discussion of this collection (Lot No. 45) under Paleontology:

Fair-Grounds Section.

Huntersville District; along the Chesapeake and Ohio Railway track one mile northeast of Marlinton and opposite the Fair-Grounds; traverse southeastward.

			Thickness. Feet.	Total. Feet.
Pocono Series (100′+)				
1. Shale, Sunbury, yellowish-brown to dark, alternating with thin brown to dark sandstone			35	35
2. Sandstone, fine-grained, green, platy; thin sandstone conglomerate near middle	25′	Berea	65	100
3. Sandstone, conglomeratic, earthy-brown; large and small quartz pebbles	15			
4. Shale, olive-brown, alternating with grayish-brown micaceous sandstones 3″ to 6″ thick	10			
5. Sandstone, grayish-brown, cross-bedded	15			
Catskill Series (220′+)				
6. Sandstone, red and gray with lenses of red shale			20	120
7. Shale, red and olive: sandy and dark at top	15′	Saxton Shale	55	175
8. Shale, red, sandy, with 8″ of green shale near top	25			
9. Sandstone, grayish-brown	5			
10. Shale, green, olive and red, sandy	10			
(A loose slab of sandstone from this horizon revealed a number of fish plates and teeth; see Lot 45).				
11. Sandstone, grayish-brown, massive, irregularly bedded, with pockets of plants carbonized to coal			25	200

	Thickness. Feet.	Total. Feet.
12. Sandstone, gray and brown	5	205
13. Sandstone, red, shaly	15	220
14. Shale, red, and concealed	100+	320+

MEASURED SECTIONS, LITTLE LEVELS DISTRICT.

Little Levels District is situated in the southwestern part of Pocahontas and comprises the remainder of the county southwest of Edray and Huntersville Districts. It extends southward from the divide between the waters of Williams River and Middle Fork, including the watershed of the latter stream, Cranberry River, Cherry River, and Hills Creek, and crosses east of the Greenbrier River to include the area south of Beaver Creek and west of North Fork of Anthony Creek. Within its limits an almost complete geologic column of the county is represented, including the lower portion of the Kanawha Group of the Pottsville Series on Yew Mountain, down to and including the White Medina Series on Beaver Lick Mountain.

The following section, measured by the writer, is composed entirely of the three basal groups of the Mauch Chunk Series which are found along the trail from Stamping Creek to the low divide between this stream and Cranberry River, and thence to the high point on Cranberry Mountain. The section has been arranged in descending stratigraphic order:

Stamping Creek Section.

Little Levels District; beginning at a high point (4215′ B.) on Cranberry Mountain and traversing southwestward to the trail crossing low divide at head of Stamping Creek and thence southeastward along the trail to Raintown; measurement by aneroid.

	Thickness. Feet.	Total. Feet.
Mauch Chunk Series—Princeton Group (10′)		
1. **Sandstone, Princeton**; point capped by boulders of conglomerate	10	10
Mauch Chunk Series—Hinton Group (480′)		
2. Concealed	105	115
3. Sandstone, grayish-brown, massive, makes bluff	10	125
4. Concealed	250	375
5. Sandstone, large flat bench made by sandstone	50	425
6. Concealed	50	475

	Thickness. Feet.	Total. Feet.
7. **Sandstone, Stony Gap**, brown, hard, fine-grained; weathers white; makes low gap at divide, exposed	15	490
Mauch Chunk Series—Bluefield Group (1045′)		
8. Concealed	200	690
9. **Sandstone, (Big Spruce Knob)**, light-brown, massive; makes bluff	75	765
10. Shale, red	25	790
11. Concealed	25	815
12. Sandstone, reddish-brown, massive, fine-grained; weathers white	50	865
13. Concealed	260	1125
14. Sandstone, red, cross-bedded; makes bluff	10	1135
15. Shale, red	20	1155
16. Shale, dark (has been prospected for coal)	5	1160
17. Shale, red	20	1180
18. Concealed	45	1225
19. Shale, red	50	1275
20. Concealed	120	1395
21. Limestone, shaly, fossiliferous ... 15′; 22. Shale, gray or brown, calcareous ... 10; 23. Limestone, shaly, fossiliferous ... 15 — **Reynolds Limestone**	40	1435
24. Shale, dark and olive	45	1480
25. **Limestone, Glenray**, dark, fossiliferous	5	1485
26. Concealed	10	1495
27. **Sandstone, Edray**, grayish-brown, fine-grained	10	1505
28. **Shale, Lillydale**, dark-green, red and sandy	30	1535
Greenbrier Series (45′+)		
29. **Limestone, Alderson**, cross-bedded, impure, shaly, with 5′ of gray oolite	20	1555
30. Limestone, reddish-gray, massive, cross-bedded; crinoid stems and plates, brachiopods, cup corals, and **Archimedes**; 1′ of limestone and mud-ball concretion near top	25	1580

The following section, measured by the writer and arranged in descending stratigraphic order, affords a view of the basal Coal Measures including the **Sewell Coal**. A complete section of the Mauch Chunk Series was measured by aneroid, using vertical measurements on rising strata, thus shortening its true thickness by approximately 400 feet. An attempt was made to reopen the Sewell Coal here at the prospect of the Preston Clark Heirs, from which considerable coal was mined several years ago. In order to get a true thickness several hours were spent by the writer, Walter Mason, and Lee Clark, one of the heirs, in facing up the coal as indicated below:

Briery Knob Section.

Little Levels District; beginning at high point on Briery Knob and following southeastward along the old coal road to forks near Mt. Lebanon Church and thence northeastward to Hills Creek.

			Thickness. Feet.	Total. Feet.
Pottsville Series—New River Group (431')				
1.	Sandstone, (Harvey Conglomerate), grayish-brown, weathering almost white, coarse......		15	15
2.	Concealed in flat bench........................		90	105
3.	Sandstone, Guyandot, white, weathering to white sand, coarse; small white quartz pebbles.....		55	160
4.	Shale, Hartridge, mostly concealed, but 4' of dark carbonaceous shale with plants and Naiadites? visible		35	195
5.	Coal, good, clean... 2' 4"	(6' 5")		
6.	Shale 1 10	Sewell, Preston		
7.	Coal, good, clean... 1 3	Clark Heirs Prospect		
8.	Coal, concealed..... 1 0	(No. 11 on Map II)...	6.4	201.4
9.	Concealed			
10.	Concealed, flat bench........................		24.6	226
11.	Sandstone, Upper Raleigh (Sharon), brown and white, coarse, cross-bedded, with white quartz pebbles		105	331
12.	Concealed		95	426
13.	Shale, dark, carbonaceous, Fire Creek Coal horizon		5	431
Mauch Chunk Series—Bluestone Group (297')				
14.	Sandstone, reddish-brown, shaly................		5	436
15.	Concealed		52	488
16.	Concealed in flat bench........................		165	653
17.	Shale, yellow..................................		5	658
18.	Concealed		70	728
Mauch Chunk Series—Princeton Group (50')				
19.	Concealed in bench but large conglomerate boulders (Princeton Sandstone)..................		50	778
Mauch Chunk Series—Hinton and Bluefield Groups (1018')				
20.	Shale, red......................................		200	978
21.	Sandstone, Stony Gap, red and brown, cross-bedded, makes bold cliff, shaly at top........		40	1018
22.	Shale, red......................................		125	1143
23.	Sandstone, grayish-brown, micaceous...........		25	1168
24.	Shale, red......................................		20	1188
25.	Shale, partly concealed, but mostly red.........		250	1438
26.	Sandstone, red..................................		5	1443
27.	Shale, red......................................		105	1548
28.	Sandstone, reddish-brown		10	1558
29.	Shale, red......................................		25	1583
30.	Sandstone, red..................................		3	1586
31.	Shale, red, green, sandy........................		30	1616
32.	Shale, yellow, olive, to road forks (2715' B.)....		40	1656
33.	Shale, olive, dark..............................		10	1666
34.	Limestone, Reynolds, very fossiliferous, impure, shale at top..................................		20	1686
35.	Shale, dark, olive, sandy. 35'			
36.	Shale, red............. 20	Lillydale	85	1771
37.	Shale, olive, sandy..... 30			
38.	Sandstone, Edray, grayish-brown, micaceous....		25	1796

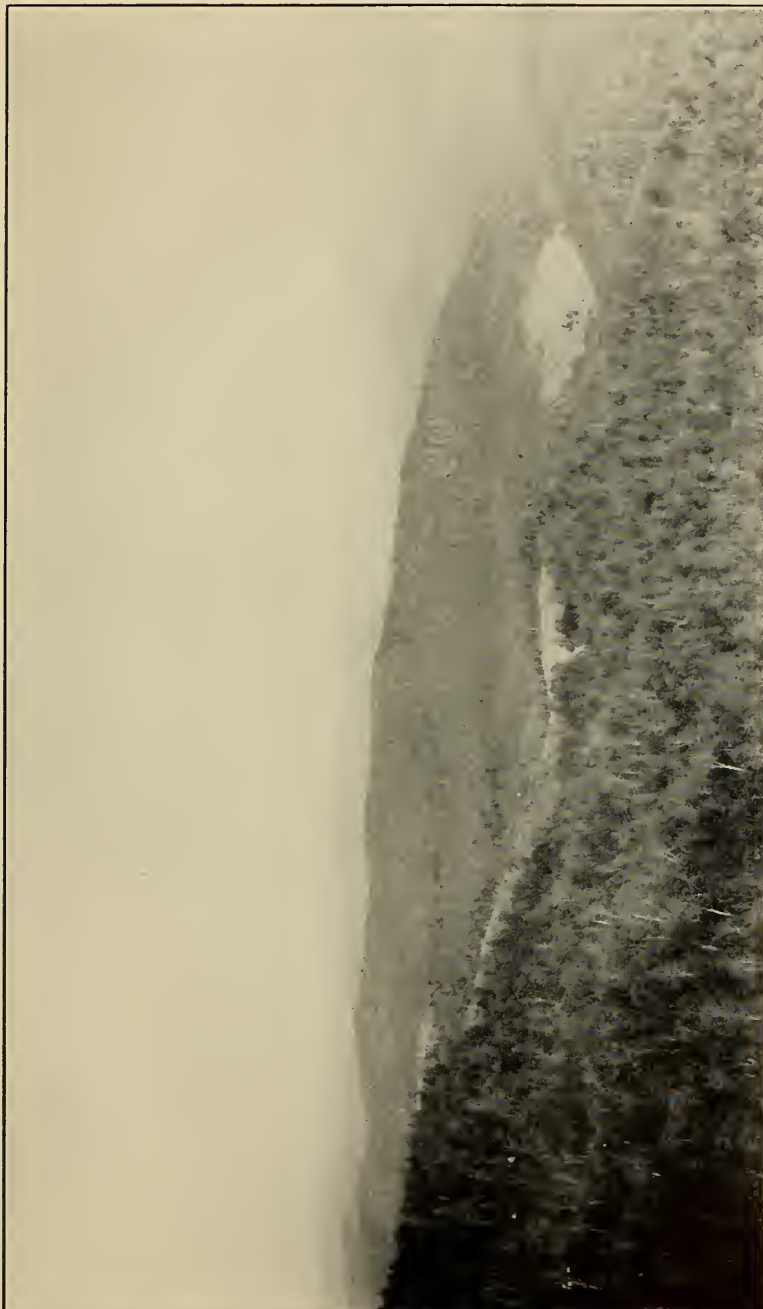

PLATE XV.—View east across Burner and other mountains from the Staunton and Parkersburg Pike on east side of Cheat Mountain above Durbin. West Fork of Greenbrier River makes valley in foreground. (Photo. by Paul H. Price).

PLATE XVI.—View from Seneca Trail near top of Elk Mountain looking southeast across Edray. Edray and vicinity are built upon the Greenbrier Limestone Series. (Photo. by Gay's Studio, Marlinton).

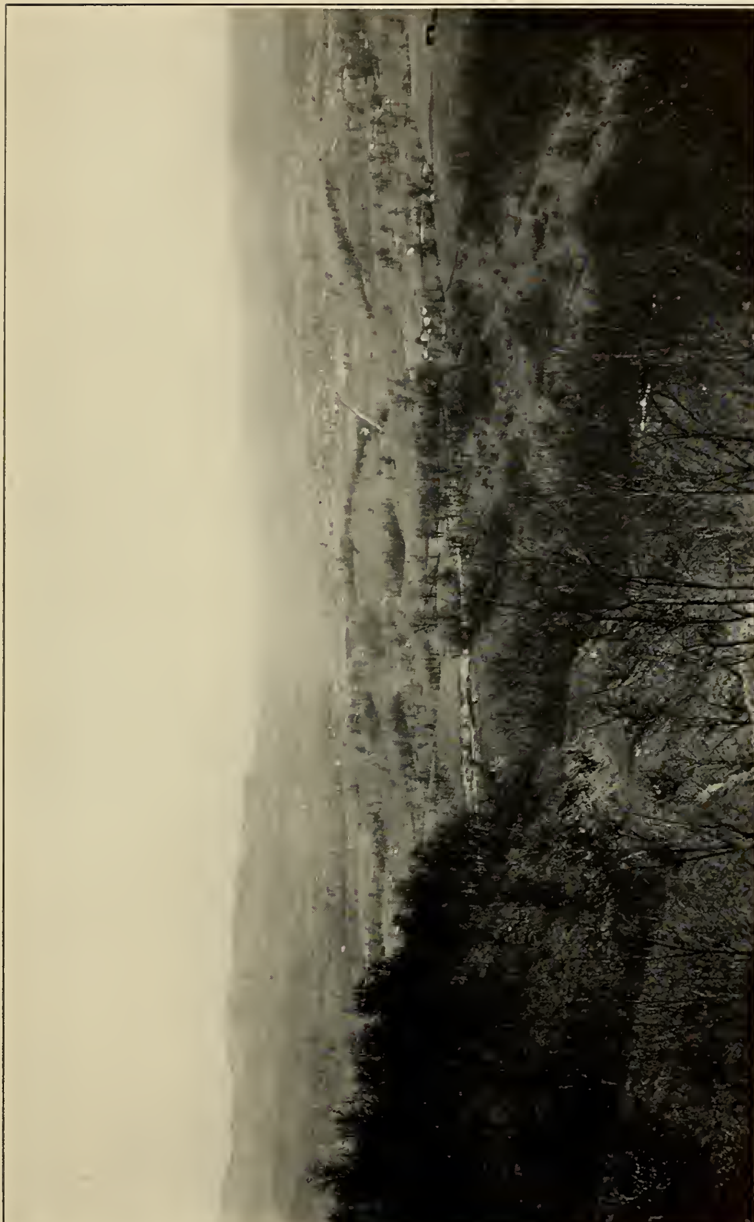

PLATE XVII.—View from Seneca Trail near top of Droop Mountain looking north across Hillsboro and vicinity. The valley is Greenbrier Series topography, while the mountains to the west and north are composed of the overlying Mauch Chunk Series. (Photo. by Gay's Studio, Marlinton).

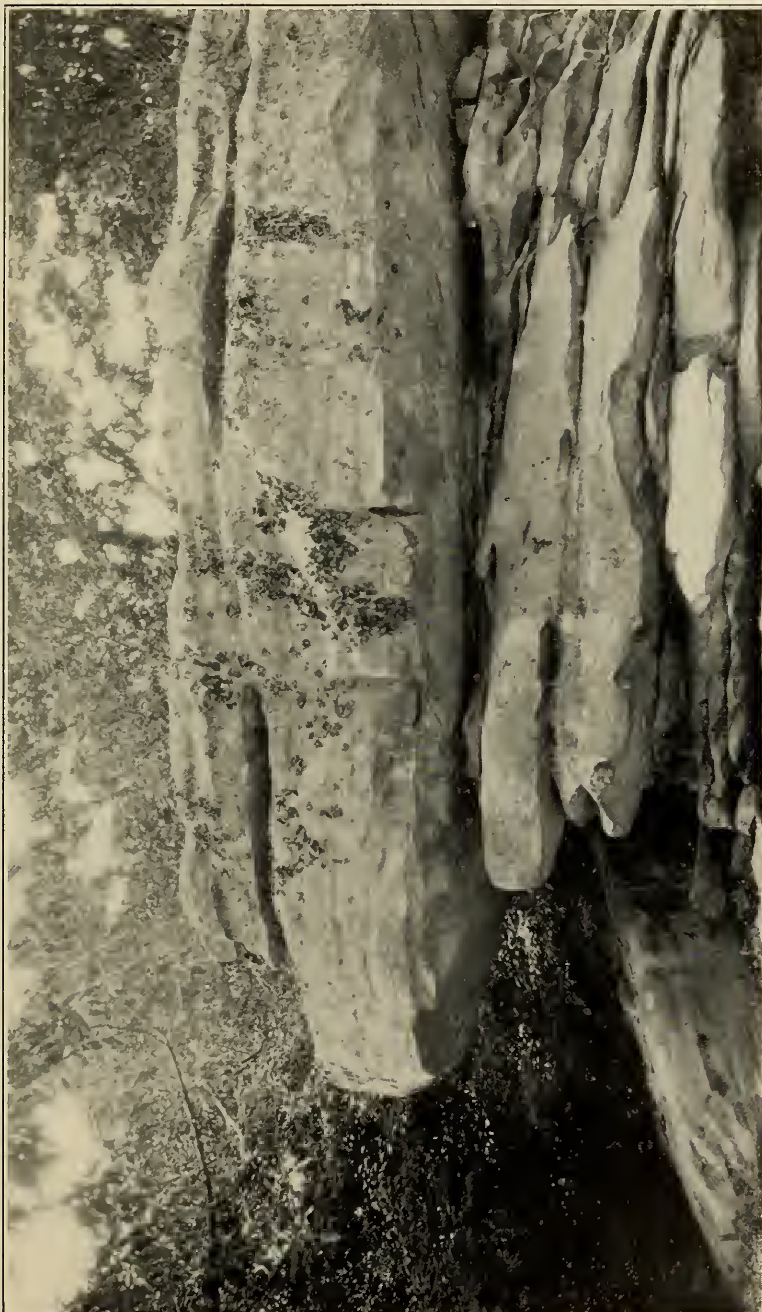

PLATE XVIII.—View of Lower Guyandot Sandstone as seen on Briery Knob, 3 miles northwest of Lobelia. (Photo. by Paul H. Price).

	Thickness. Feet.	Total. Feet.
Greenbrier Series (210'+)		
39. Limestone, Alderson, massive, gray, fossiliferous	10	1806
40. Concealed	90	1896
41. Shale, Greenville, dark, carbonaceous, fossiliferous	40	1936
42. Concealed to Hills Creek (2465' B.)............	70	2006

The following section was measured by the writer from the top of Droop Mountain, where the Droop Sandstone can be seen to its best advantage. The broad flat top of this mountain is now covered with thick deposits of sand as the weathered product of this sandstone. This sand is fine-grained but remarkably free from impurities. See chemical analyses of Samples Nos. 53 and 64. The same ground has been previously covered by Reger in an unpublished section which the writer has been permitted to inspect:

Droop Mountain Section.

Little Levels District; starting on Droop Mountain about ½ mile southwest of Spice Post-Office and traversing northeastward along the new State road, in general along the strike, to base of Taggard Limestone; thence offsetting southeastward ¼ mile, and continuing to Greenbrier River at Mill Run; measured with aneroid and hand-level.

			Thickness. Feet.	Total. Feet.
Mauch Chunk Series—Bluefield Group (309')				
1. Sandstone, Droop (type locality), light-brown to white, massive, weathering to white sand, cap rock of Droop Mountain			40	40
2. Shale, partly concealed, but greenish.........	50'	Ada	60	100
3. Shale, dark, fissile, carries septarian nodules, which upon breaking reveal fissures filled with calcite..........	10			
4. Limestone, dark, massive, fossiliferous....	5'	Reynolds Limestone	50	150
5. Shale, brown, calcareous, with limestones 1" to 2" thick.............	20			
6. Limestone, dark, hard	3			
7. Shales and limestone; dark shales and thin limestone	5			
8. Limestone, light-blue, shaly, impure, fossiliferous	17			

			Thickness. Feet.	Total. Feet.
9.	Shale, dark, calcareous. 13′	**Bickett Shale**	18	168
10.	Shale, red.............. 5			
11.	**Sandstone, Webster Springs**, reddish-brown, shaly		10	178
12.	Shale, red..		6	184
13.	**Limestone, Glenray**, gray, fossiliferous, shaly at top and bottom..............................		20	204
14.	Shale, dark-green, with occasional sand and red shale............ 55′	**Lillydale Shale**.....	105	309
15.	Shale, red and brown, sandy 50			
Greenbrier Series (605′)				
16.	Limestone, upper part crystalline, cross-bedded, fossiliferous .... 15′	**Alderson Limestone**	40	349
17.	Limestone, dark, weathering yellow, pitted, brachiopods (**Composita**), crinoids (**Pterotocrinus**) 20			
18.	Limestone, red, uneven-textured, breccia-like; contains bryozoa, (**Archimedes**), **Composita** 5			
19.	Limestone, oolitic, beautiful, massive, fossiliferous		15	364
20.	**Shale, Greenville**, red and brown, with shaly limestone		30	394
21.	**Limestone, Union**, dark-gray, fossiliferous, shaly at top; lower part oolitic with pink-colored fossils, giving beautiful polished surface, brachiopods (**Productus**, etc.), crinoids........		30	424
22.	**Limestone, Pickaway** (may be part **Union**), dark-gray, siliceous. 100′	**Pickaway Limestone**	205	629
23.	Shale, red............. 5			
24.	**Limestone, Pickaway** (continued), partly concealed, shaly.... 100			
25.	**Limestone, Taggard**, gray, oolitic, fossiliferous, with streaks of red shale.....................		25	654
26.	**Limestone, Patton**, dark, siliceous..............		100	754
27.	**Limestone, Patton**, (continued), gray, pure, fossil corals and crinoids......................		20	774
28.	**Limestone, Patton**, (continued), dark, siliceous, impure		20	794
29.	**Limestone, Patton**, (continued), dark-gray and oolitic		50	844
30.	**Shale, Patton**, red............................		5	849
31.	**Limestone, Sinks Grove**, dark and hard, with marine fossils, lower portion shaly and streaked with green..........................		50	899
32.	**Limestone, Hillsdale**, (**St. Louis** age as correlated in Kentucky), dark, with black, irregular chert.		15	914
Maccrady Series (66′)				
33.	Shale, red..		26	940
34.	Concealed		40	980

	Thickness. Feet.	Total. Feet.
Pocono Series (210′)		
35. **Sandstone, Broad Ford,** reddish-brown, thick-bedded, fine-grained, with marine fossils......	190	1170
36. Shale, green....................................	5	1175
37. Concealed to Greenbrier River..................	15	1190

The following section was measured by the writer primarily to show the relation of the Catskill Series to the overlying Pocono Series. A clean exposure here shows a slight angular unconformity between the two:

Stevens Hole Run Section.

Little Levels District; along Greenbrier River at mouth of Stevens Hole Run.

		Thickness. Feet.	Total. Feet.
Pocono Series (95′+)			
1. Concealed			
2. Shale, brown, sandy.............................		10	10
3. Sandstone, bluish-gray, fine-grained .... 20′	**Berea Sandstone....**	85	95
4. Sandstone conglomeratic, with white quartz pebbles 5			
5. Sandstone, grayish-brown, irregularly bedded 15			
6. Shale, brown, sandy, ferruginous, with quartz pebbles....... 4			
7. Sandstone, gray and brown, massive...... 10			
8. Conglomerate, earthy and ferruginous, with large and small quartz pebbles 1			
9. Sandstone, greenish-gray, micaceous, speckled with iron; weathers brown...... 30			
Unconformity (slightly angular)			
Catskill Series (17′+)			
10. Shale, brown, sandy............................		4	99
11. Shale, red, sandy..............................		8	107
12. Sandstone, reddish-brown......................		5	112

This section is a good example to show the change in deposition from Catskill Series to Pocono Series.

MEASURED SECTIONS, GREENBANK DISTRICT.

Greenbank District is located in the northern end of the county and comprises the entire area north of a line from Mace to Raywood and thence along the east side of Greenbrier River to Clover Lick and thence in a meandering line to the Virginia State line on Allegheny Mountain. Its surface rocks range from the Kanawha Group of the Pottsville Series down nearly to the top of the Red Medina. Opportunities for measuring good sections are not readily afforded, since the area north of the Staunton and Parkersburg Pike has practically no roads with very few trails. The precipitous Back Allegheny Mountains is likewise very inaccessible either on foot or horseback. The best opportunity for a section of any length is along the new road cuts on the Staunton and Parkersburg Pike from the divide on Back Allegheny to the Greenbrier River at Durbin. A section measured along this road reveals the decrease in thickness of the Mauch Chunk, Greenbrier, and Pocono Series with an increase in the Catskill Series as contrasted to the same series in the southern end of the county. The section, which covers the same ground as an unpublished measurement by Reger but which differs in certain details of correlation and interpretation, is as follows:

Durbin Section.

Greenbank District; beginning on Back Allegheny Mountain ¾ mile south of where the Staunton and Parkersburg Pike crosses the Pocahontas-Randolph County line and traversing northward to this point and then southeast along this pike to the West Fork of the Greenbrier River at Durbin; dip is to the northwest 10° to 18°; arranged in descending order; measurement with aneroid and hand-level.

	Thickness. Feet.	Total. Feet.
Pottsville Series—New River Group (165′+)		
1. Sandstone, Sharon (Upper Raleigh), conglomeratic: white sand grains with white quartz pebbles, 15′ to	25	25
2. Concealed	140	165
Mauch Chunk Series—Bluestone, Princeton, and Hinton Groups (560′)		
3. Concealed, with red shale, to pike and top of Stony Gap Sandstone	540	705
4. Sandstone, Stony Gap, grayish-brown, massive; dip 10° N. W.	20	725

	Thickness. Feet.	Total. Feet.
Mauch Chunk Series—Bluefield Group (435')		
5. Shale, red	25	750
6. Shale, red and grayish-green, sandy	20	770
7. Sandstone, (Big Spruce Knob), grayish-brown, massive, fine-grained	30	800
8. Shale, red	140	940
9. Concealed	40	980
10. Shale, red	30	1010
11. Concealed and red shale	35	1045
12. Sandstone, Droop?, red, cross-bedded	15	1060
13. Shale, red and green	10	1070
14. Limestone, hackly, impure, weathering yellow, very fossiliferous; Orthotetes, Spirifer, crinoid stems, cup corals, bryozoa, gastropods 15' 15. Shale, red 10 16. Limestone, red, siliceous, with fossils 10 17. Limestone, blue, weathering yellow 10 Reynolds, (Top, 3400' B.)	45	1115
18. Sandstone, Webster Springs, reddish-brown	5	1120
19. Shale, red	10	1130
20. Limestone, Glenray, red and shaly	10	1140
21. Concealed	20	1160
Greenbrier Series (205')		
22. Limestone, Alderson, hackly at top, weathering yellow; contains Orthotetes, Composita, crinoids, and gastropods. (See Lot 24). Base is dark-gray, massive, and cross-bedded	40	1200
23. Sandstone, Cypress, red, shaly	20	1220
24. Limestone, Union, (Gasper portion), red, cross-bedded, siliceous, streaked with calcite at top but grading into gray; weathers white; pure oolite	50	1270
25. Sandstone, Bethel, red, shaly, calcareous	10	1280
26. Limestone, Union, (Fredonia portion), gray, weathering white, oolitic	35	1315
27. Concealed	40	1355
28. Limestone, Patton, greenish-gray, earthy	10	1365
Maccrady Series (30-40')		
29. Shale, red, partly concealed	40	1405
Pocono Series (60')		
30. Concealed and grayish-brown sandstone	20	1425
31. Sandstone, Berea, grayish-brown, with small quartz pebbles	40	1465
Catskill Series (840')		
32. Shale, red and olive	15	1480
33. Sandstone, olive-brown, shaly	15	1495
34. Shale, red, green and olive	15	1510
35. Sandstone, gray or brown, shaly at base	30	1540
36. Shale, green (road forks to Cass 3135' B.)	10	1550
37. Shale, red	15	1565
38. Sandstone, greenish-brown, stained with iron	30	1595
39. Shale, red	20	1615

	Thickness. Feet.	Total. Feet.
40. Shale, yellow, sandy	20	1635
41. Sandstone, gray, brown or red, cross-bedded	40	1675
42. Shale, red, green or olive, sandy	200	1875
43. Sandstone (plant collection by Reger, David White, and Price*), grayish-green to brown shaly near middle	150	2025
44. Shale, red, very sandy	10	2035
45. Sandstone, greenish-gray, platy, weathering brown; makes cliff	30	2065
46. Shale, olive, red or green	15	2080
47. Sandstone, blue or green, with carbonized plants, (collection by Reger, White, and Price*)	25	2105
48. Concealed at bend (2890′ B.)	100	2205
49. Sandstone, grayish-green	10	2215
50. Shale, olive-green	10	2225
51. Shale, olive-green	5	2230
52. Sandstone, green, with lenses of red; makes cliff at bridge over West Fork of Greenbrier River at Durbin	25	2255
53. Concealed, with sandstone in bed of river	25	2280
54. Sandstone, reddish-brown, with red and green shale in Western Maryland Railway cut	15	2295
55. Sandstone, green, medium-coarse, in railway cut	10	2305
Chemung Series ( )		
56. **Sandstone, Hendricks**, green, flaggy, with fossils; crinoids and brachiopods; exposed just east of railway		

MEASURED SECTIONS IN ADJOINING COUNTIES.

It is considered advisable in a geological report of this kind to include such available information on adjoining areas as may be necessary to show the relation thereto. This is often the case, where opportunities are afforded beyond the limits of a county under discussion where better conditions for study are present. This condition is true with reference to the adjoining area on the west as well as a portion of the area to the north. The following sections are therefore included in this report.

The following section is a record of the W. Va. Pulp and Paper Company coal test boring on Snyder Knob, Mingo District, Randolph County, located two miles northwest of the Pocahontas County line and 0.7 mile west of Hopkins. The interpretations are by Reger. The section is an important one for this area since it affords an opportunity to study in detail the remaining Pottsville Series with accurate

*The identifications of these collections were not completed in time to be included in this report.

vertical intervals to the key-horizons. The coal that has been mined here for some years by the West Virginia Pulp and Paper Company is regarded as the Gilbert by Reger:

W. Va. Pulp & Paper Co. No. 1 Coal Test Boring.[2]

Mingo District, Randolph County; on Snyder Knob of Cheat Mountain, 0.7 mile west of Hopkins; elevation, 4441' B.

	Thickness. Ft.	In.	Total. Ft.	In.
Pottsville Series (380' 7")				
Sandstone, Lower Gilbert	31	6	31	6
Coal 0' 6" Sandstone 0 10 Coal 4 4 } Gilbert (4404' B.)	5	8	37	2
Fire clay	6	0	43	2
Sandstone, Dotson and Nuttall	136	0	179	2
Slate	20	0	199	2
Fire clay	15	0	214	2
Slate and coal mixed, Sewell "B" (4226' B.)	1	3	215	5
Sandstone, Guyandot	40	0	255	5
Fire clay	12	0	267	5
Slate and coal, mixed, Sewell (4168' B.)	6	0	273	5
Fire clay	6	0	279	5
Sandstone, Upper Raleigh (Sharon)	70	8	350	1
Fire clay	8	6	358	7
Sandstone	22	0	380	7
Mauch Chunk Series (113' 6")				
Shale, red	16	0	396	7
Shale, blue	8	6	405	1
Sandstone, conglomerate	3	0	408	1
Shale, red	14	0	422	1
Shale, conglomerate, red	3	0	425	1
Shale, red	5	0	430	1
Shale, blue	64	0	494	1

The following sections are taken from the Webster County Report and reproduced here because of their proximity and close relation to the area under discussion in this report:

Three Forks of Gauley Section.[3]

	Thickness. Feet.	Total. Feet.	
Pottsville Series—Kanawha Group (200')			
Sandstone, massive, with small pebbles, Lower Gilbert, capping knob	50	50	
Concealed	50	100	
Spring, with coal blossom, Gilbert (3660' B.)	..	100	100'

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[2]The Cheat Mountain Coal Field of Randolph County, West Virginia, Bull. Three, W. Va. Geol. Sur., p. 14, 1928.

[3]Webster County Report, W. Va. Geol. Sur., p. 107, 1920.

	Thickness. Feet.	Total. Feet.	
Concealed	30	130	
Sandstone, **Dotson**, and concealed	55	185	
Spring, **Douglas Coal horizon** (3575′ B.)	..	185	85′
Concealed	15	200	
Pottsville Series—New River Group (530′)			
Sandstone, massive, with small pebbles, cliff rock, **Upper Nuttall**	45	245	
Concealed	165	410	
Sandstone, massive, pebbly, cliff rock, **Harvey**	45	455	
Fire clay spring, **Castle Coal horizon** (3305′ B.)	..	455	270′
Concealed	154	609	
Spring, with coal, **Sewell** (3150′ B.); (Prospect No. 685 on Map II); visible	1	610	155′
Concealed	15	625	
Steep bank, with sandstone, **Welch**	50	675	
Concealed in bench	10	685	
Concealed in steep bank, with sandstone, **Upper Raleigh** (3035′ B.)	45	730	
Mauch Chunk Series (180′)			
Shale, red	35	765	
Sandstone, massive, partly concealed, pebbly, **Princeton Conglomerate**, to Three Forks of Gauley	145	910	

Three Forks of Williams Section.[4]

	Thickness. Feet.	Total. Feet.	
Pottsville Series—Kanawha Group (115′)			
Sandstone, massive, with small pebbles, **Lower Dotson** (3160′ B.)	90	90	
Concealed in bench	25	115	
Pottsville Series—New River Group (595′)			
Sandstone in steep bank, **Upper Nuttall**	105	220	
Concealed in slope	50	270	
Slate and **coal blossom**, (2980′ B.)	..	270	
Concealed	20	290	
Slate, black	9	299	
Coal (1′ 0″), **Hughes Ferry**? (2950′ B.)	1	300	300′
Fire clay and concealed	5	305	
Sandstone, massive, cliff, **Harvey**	15	320	
Concealed	110	430	
Slate, black	..	430	
Sandstone, massive, partly concealed, **Lower Guyandot**	70	500	
Concealed and black slate, with **Lingulae**, **Hartridge**	7	507	
Coal 0′ 8″; Slate, gray 0 6; **Coal**, soft 1 7 — (2′ 9″) **Sewell** (2740′ B.) (Prospect No. 696 on Map II)	3	510	210′
Slate and concealed in steep bank	90	600	
Bench	..	600	

[4]Webster County Report. W. Va. Geol. Sur., pp. 118-19, 1920.

	Thickness. Feet.	Total. Feet.	
Concealed	110	710	
Mauch Chunk Series (175')			
Shale, red, and concealed	65	775	
Sandstone, massive, Princeton	35	810	300'
Shale, red, to Three Forks of Williams River	75	885	

Dogway Section.[5]

	Thickness. Feet.	Total. Feet.	
Pottsville Series—Kanawha Group (300')			
Sandstone, massive, Grapevine? (3875' B.)	35	35	
Concealed in slope	250	285	
Bench, Lower Douglas Coal horizon (3610' B.)	15	300	300'
Pottsville Series—New River Group (580')			
Sandstone, massive, cliff rock, coarse, Upper Nuttall	35	335	
Bench	25	360	
Sandstone, massive, pebbly, cliff rock, Lower Nuttall (3510' B.)	40	400	100'
Concealed	160	560	
Bench, Castle Coal horizon (3350' B.)	..	560	160'
Sandstone, massive, Guyandot	25	585	
Concealed	60	645	
Sandstone, massive, Lower Guyandot	25	670	
Bench, with black slate, Sewell Coal horizon (3190' B.)	..	670	110'
Concealed, with black slate	80	750	
Shale, sandy, and concealed	45	795	
Sandstone, shaly, Quinnimont	30	825	
Shale, sandy, Quinnimont	20½	845½	
Coal, Fire Creek; Cherry R. B. & L. Co. mine (No. 754 on Map II) (3060' B.)	4½	850	180'
Concealed and sandy shale to Dogway Fork	30	880	

SUMMARY OF MEASURED SECTIONS.

For convenient reference the thickness of the stratified rocks of Pocahontas County along with a few sections at strategic points in adjoining counties, as determined by the measured sections in this chapter, is compiled in the following table, showing thickness of the various groups and series as well as totals for the entire periods as far down as available. A line of dots (...) under a group or series indicates that this group or series was not exposed or in some cases not examined. A (+) indicates that only a portion of the group or series was exposed. Occasionally two or more

[5]Webster County Report, W. Va. Geol. Sur., pp. 121-22; 1920.

groups, where exact contacts were not discernible, were measured collectively and are included in parentheses ( ). In some cases sections were made for some distance across the dip of the rocks, resulting in a thickness that is either too large or too small, depending upon the direction of dip and traverse. In most cases these have been corrected and show approximately true thickness but elsewhere corrections were not always practicable. An explanation accompanies each section where published in the text, explaining the conditions under which it was made, and should be referred to before assuming that the tabulated thicknesses are correct:

Table Showing Thickness at Measured Sections of Pocahontas and Adjacent Areas.

	Kanawha	New River	Bluestone	Princeton	Hinton	Bluefield	Greenbrier	Maccrady	Pocono	Catskill	Chemung	Total
Edray		150+	110	70	545	731	407	30	253+			2296
Kee Flats									450			450
McLaughlin Springs							25+	23	50+			98
Sitlington										400		400
Props Run	(640)		100	50	(1020)							1810
Slaty Fork		500	100	50	415	815	10+					1890
Onoto						280+	500	20	41+			841
Elklick Run		100+	100	50	535	740	510	30	210	70+		2345
Big Spruce Knob		40+	240	40	(1597)		546		309	874	696+	4342
Fair-Grounds									100+	220+		320
Stamping Creek				10+	480	1045	45+					1580
Briery Knob		431+	297	50	(1018)		210+					2006
Droop Mountain						309+	605	66	210+			1190
Stevens Hole Run									95+	17+		112
Durbin		165+		(560)		435	205	30—40	60	840	( )	2305
Three Forks Gauley	200+	530	180									910
Three Forks Williams	115+	595	175									885
Dogway	300	580										880
Snyder Knob	(381)		113+									494

Table Showing Thickness at Measured Sections of Pocahontas and Adjacent Areas (Continued).

	Pocono	Catskill	Chemung	Portage	Genesee	Hamilton	Marcellus	Oriskany	Helderberg	Bossardville	Rondout	Niagara	Clinton	White Medina	Red Medina	Total
Knapp Creek	70+	655	3185	2410	150	(600)		100	(800)			40	501	188	401	9100
Rainbow Run							120+	130	380	325	100	90	465	50		1760

CHAPTER VI.

STRATIGRAPHY—POTTSVILLE SERIES.

GENERAL ACCOUNT AND SECTION, POTTSVILLE SERIES.

The Pottsville Series of the Pennsylvanian, representing the base of this period and lying just over the Mauch Chunk Series, comprises the youngest stratified beds of Pocahontas County. The Pottsville Series was first named and described by Pennsylvania geologists from its occurrence at Pottsville, eastern Pennsylvania, where it is composed of numerous conglomeratic sandstones accompanied by anthracite coal seams. Later it was subdivided by Dr. I. C. White into the Upper Pottsville, or Kanawha Group, the Middle Pottsville, or New River Group, and the Lower Pottsville, or Pocahontas Group, and of these subdivisions custom has sanctioned the use of the geographic names last mentioned, because of their relation to the Kanawha and New River coal fields of southern West Virginia, and to the Pocahontas field in southern West Virginia, and Virginia. Of these three groups the Pottsville Series is represented in Pocahontas County only by the lower portion of the Kanawha Group, and by the New River Group, the entire Pocahontas Group not being found this far north. The Pottsville Series covers a large portion of the surface of the county west of Greenbrier River, as outlined on Map II and on Figure 5 of the accompanying text. This series invariably makes a rugged topography. A detailed description of each group appears under its proper heading in succeeding pages.

The general section was compiled to show the development of this series in Pocahontas County. It should be stated, however, that the area in which this series occurs does not afford good exposures for study. The region is very inaccessible being covered with a dense forest growth, being without roads or trails of any consequence, and having few places where lodging is available. It is believed, however, that the information at hand is of sufficient accuracy as to be of considerable value to future prospectors, or for further detailed study.

Pocahontas County occupies a position about midway between the Pennsylvania State line, where the Pottsville is approximately 250 feet thick, and the Virginia State line, bordering McDowell County, where the Kanawha and New River Groups attain a thickness of approximately 3,130 feet. with 720 feet additional in the Pocahontas Group, not present in northern West Virginia, making the maximum Pottsville section for southern West Virginia 3,850 feet. In contrast to the two extremes from opposite ends of the State, the Kanawha Group, which is only partially retained, and the New River Group of Pocahontas County, have a total thickness of approximately 740 feet. They contain coals, sandstones, and other members not known in the northern end of the State or in western Pennsylvania, but at the same time lack many of the great coal seams, sandstones, and fossiliferous limestones and shales found in southern West Virginia. Owing to the fact that the first geologic study of the Pottsville was made in Pennsylvania and was later followed by an entirely distinct classification in southern West Virginia in the region of maximum thickness, with practically a new nomenclature, it became necessary in the later reports on the central counties to recognize two distinct titles for several important horizons. In the Webster County Report Reger[1] has successfully interpreted the correlations, giving precedence to the Pennsylvania nomenclature in those members coming above the Kanawha Black Flint (these beds do not occur in Pocahontas County) and to the southern West Virginia nomenclature for those coming below this member, because of the great amount of geologic and commercial literature that contains these titles. It is therefore deemed advisable to follow the same nomenclature in this Report, as expressed in the following general section:

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[1]David B. Reger, Webster County Report, W. Va. Geol. Sur., 1920.

General Section, Pottsville Series, Pocahontas County.

	Thickness. Feet.	Total. Feet.
Kanawha Group (220′)		
Sandstone, Lower Gilbert, gray, massive, making steep bluffs and forming the tops of many high ridges	30 to 80	80
Coal, Gilbert "A", bony	2	82
Shale, Gilbert, dark	20	102
Coal, Gilbert, soft, slaty	0 to 6	108
Shale	0 to 22	130
Sandstone, Dotson, gray, massive	20 to 65	195
Shale, etc., poorly exposed	10 to 25	220
New River Group (522′)		
Sandstone, Upper Nuttall, brown, coarse	30 to 80	300
Shale, etc., pooriy exposed	20	320
Sandstone, Lower Nuttall, massive, pebbly; makes cliff rock and caps ridges in great boulders on Cranberry, Williams, and Gauley drainage basins	50 to 70	390
Shale, Upper Iaeger, nearly always concealed.	20	410
Coal, Hughes Ferry, soft, columnar	3 to 4	414
Shales, etc., poorly exposed	5 to 10	424
Sandstone, Harvey Conglomerate, gray to white, hard, coarse	10 to 20	444
Shale, etc., poorly exposed, should contain Castle Coal	0 to 10	454
Sandstone, Guyandot, gray, brown, coarse, weathers white	15 to 25	479
Sandstone, Lower Guyandot, white, weathering to white sand, coarse, with fine white quartz pebbles	10 to 40	519
Shale, Hartridge, dark and laminated, with plant and marine fossils	5 to 35	554
Coal, Sewell, soft, columnar, with occasional partings	2 to 6	560
Shale	10 to 25	585
Sandstone, Upper Raleigh (Sharon), gray, massive, with quartz pebbles	35 to 50	635
Shale	5 to 10	645
Sandstone, Quinnimont, brown, fine-grained, cross-bedded, lenticular	5 to 50	695
Shale and thin flaggy sandstone	5 to 15	710
Coal, Fire Creek, single-bedded	$1\frac{1}{2}$ to 2	712
Sandstone, Pineville, gray or brown, coarse, massive	5 to 30	742
Mauch Chunk Series		

SUBDIVISIONS, POTTSVILLE SERIES.

Of the three main groups into which the Pottsville Series has been divided by Dr. I. C. White, that is, Kanawha, New River, and Pocahontas, only the former two remain in Pocahontas County, the latter group having entirely disappeared south of this area. The minor subdivisions, as believed or known to occur, together with their sequence, are indicated in the above general section.

TOPOGRAPHIC EXPRESSION, POTTSVILLE SERIES.

The topography of the Pottsville Series in Pocahontas County, as in all other counties of the State in which the series outcrops in a large degree, is rough, rugged, and mountainous. The thick massive sandstones and conglomerates, cut across by streams, leave standing huge cliffs which make bold shoulders along their valleys and from which much talus accumulates on the slopes and in the stream beds below, the drainage basins of Cheat, Elk, Gauley, Williams, Middle Fork, and Cranberry Rivers being quite typical. The precipitous mountain scarp of Back Allegheny is capped by this series, the westward dipping beds on the western slope of the mountain having the appearance of a gently rolling surface but when examined closely, proving to be unusually rough from the accumulation of a talus of large sandstone boulders. Invariably the series produces a very poor soil, unfit for cultivation so that the land is seldom cleared.

AREAL EXTENT, POTTSVILLE SERIES.

The outcrop of this series is confined to the western part of the county and lies entirely west of the Greenbrier River. It includes the western portion of Little Levels and Edray Districts and the western edge of Greenbank District. In Huntersville District this series does not occur. Figure 5, prepared by George W. Grow, shows at a glance the outcrop of this series. It may also be noted in much more detail on Map II of the Atlas which accompanies this report.

CONTACTS, POTTSVILLE SERIES.

The contact of the Kanawha Group of the Pottsville with the underlying New River Group is marked by the prominent Nuttall Sandstones whose massive character and per-


FIG. 5
MAP
OF
POCAHONTAS Co.
SHOWING
OUTCROPS OF
POTTSVILLE SERIES
SCALE: 1" = 8 MILES
RANDOLPH COUNTY
PENDLETON COUNTY
HIGHLAND COUNTY
VIRGINIA
WEBSTER COUNTY
GREENBRIER COUNTY
BATH COUNTY
ALLEGHANY CO
EDRAY
LITTLE LEVELS
HUNTERSVILLE
GREENBANK
MARLINTON
PHP

sistency afford a good horizon for subdivision, there being little evidence of disconformity.

At the base of the New River Group of the Pottsville Series, however, there is an unconformity that is quite general and as extensive as the series itself. At this horizon the gray, brown, massive and often pebbly sandstones, with their associated coals and shales containing plant fossils of Upper Carboniferous aspects, rest upon the Mauch Chunk Series composed of red and green sandstones and shales, with several marine fossil zones and plants of a much earlier type. The Mauch Chunk is also characterized by the absence of any coals of minable thickness and purity, the coaly beds being limited to thin streaks and lenses.

FOSSIL LIFE, POTTSVILLE SERIES.

In the Pottsville Series throughout southern West Virginia fossil plant life is abundant and well preserved in the shales associated with the coals and often in the sandstones. These have been widely studied by many authorities[2]. In the area under discussion, however, conditions were not favorable for collecting, and only one small collection (No. 36) was made, and this was done because of the peculiar association of what appeared to be fruitage, or seed-like bodies, with stems of apparent **Calamites**. This collection, as well as all other collections made, has been examined by Dr. John L. Tilton and his discussion appears in Notes on Paleontology, Chapter XV.

In contrast to the abundant plant life is the scarcity of marine, brackish, or fresh-water faunas. In other counties a few marine zones are reported in the Kanawha and New River Groups. The black shale (Hartridge) immediately over the Sewell Coal often contains **Naiadites elongata.**

CORRELATION, POTTSVILLE SERIES.

Owing to the great amount of thinning northeastward and a greater amount of thickening southwestward across

[2]See Vol. V(A), Part II, W. Va. Geol. Sur., 1913, for discussion of many of these plants by David White.

the State, the problem of proper correlations in this series is much complicated. As pointed out in previous paragraphs, a study of the general section of this series reveals the fact that the detailed subdivisions of this series remaining in the county follow the nomenclature of central and southern West Virginia. The series has now been examined all the way across West Virginia so that conclusions on the identity of important key rocks may be made.

The Nuttall Sandstone, with which the New River Group begins, has been traced from the New River region northeastward across Webster, Pocahontas, and Randolph Counties. The Guyandot Sandstone of southern West Virginia appears to follow the Sewell Coal outcrop across the State. The Sewell Coal of southern West Virginia appears to be the same as the Sharon Coal of Pennsylvania, its actual tracing by outcrop across the State having now been completed by members of the West Virginia Geological Survey. The Upper Raleigh Sandstone, lying slightly below the Sewell Coal, has also been traced across the State, retaining in general its conglomeratic character, and correlating with the Sharon of Pennsylvania. The correlation of these two groups across the State offers a sharp contrast to the Pocahontas Group which thins out entirely in the central part of the State.

DESCRIPTION OF MEMBERS, KANAWHA GROUP OF POTTSVILLE SERIES.

The Kanawha Group of White,[3] comprising the upper portion of the Pottsville Series, is the youngest group of stratified rocks remaining in Pocahontas County, and is represented only by its basal portion, with a maximum thickness of 220 feet. It consists mainly of massive gray sandstones that weather white, separated by sandy or carbonaceous shales and an occasional coal. This group occurs in the tops of the mountains so that exposures, other than the sandstone ledges, are seldom seen. For this reason the known character of the intermediate horizons is quite indefinite.

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[3] I. C. White, Vol. II, W. Va. Geol. Sur., pp. 500-502; 1903.

LOWER GILBERT SANDSTONE.

The **Lower Gilbert Sandstone** of Hennen and Reger[4] is believed to be the youngest stratified rock in Pocahontas County. It was named for its exposure on the Guyandot River at Gilbert, Mingo County, where it is a massive cliff rock, and has been traced across the intervening counties into Pocahontas, where it retains its massive character and is found capping the high ridges along the western border of the county. It is massive, coarse-grained, grayish-brown but weathering white, very hard and resistant, making cliffs and knobs, and varies in thickness from 30 to 80 feet. Its best exposures are found capping the high knobs in the western part of Edray District, with an occasional high knob retaining the sandstone in western Greenbank and northern Little Levels Districts.

GILBERT "A" COAL.

The **Gilbert "A" Coal** of Hennen[5], or a coal that appears at its approximate horizon, was examined at the head of Lost Run of Cranberry River. Here a thin coal coming 35 feet above another coal which is correlated as the Gilbert Coal was measured, as follows:

				Ft.	In.
Sandstone and concealed				..	..
Slate and shale				8	0
Coal, bony	0′	6″	Gilbert "A" Coal	2	2
Coal, bony	1	2			
Coal, poor	0	6			
Shale, carbonaceous				3	0
Concealed				..	..

This is the only location at which this coal was seen. This does not mean, however, that its extent is confined to one locality, but that no other opportunity was found available to prospect it.

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[4]Ray V. Hennen and David B. Reger, Logan and Mingo County Report, W. Va. Geol. Sur., p. 219; 1914.

[5]Ray V. Hennen, Wyoming and McDowell Report, W. Va. Geol. Sur., p. 167; 1915.

GILBERT SHALE.

The **Gilbert Shale** of Hennen[6], named from Wyoming County where it comes under the Lower Gilbert Sandstone and contains marine fossils, is present in Pocahontas County, and occurs between the Gilbert Coal and the overlying Lower Gilbert Sandstone, or Gilbert "A" Coal when present. At the head of Lost Run of Cranberry River it occupies the interval between these two coals and has a thickness of 20 feet. It was not completely exposed but no fossils were observed at this horizon.

GILBERT COAL.

The **Gilbert Coal** of Hennen and Reger[7], named from its occurrence on the Guyandot River at the town of Gilbert, Mingo County, where it belongs a few feet below the Lower Gilbert Sandstone, was observed in Pocahontas County near the head of Little Red Run northwest of Cranberry Glades. It is also recorded in the Snyder Knob Section occurring on Cheat Mountain two miles north of the Pocahontas-Randolph County line and being pertinent to this report. Here it has been mined by the West Virginia Pulp and Paper Company at the Hopkins Mine for use in lumber operations. At these two localities it varies in thickness from 5′ to 8″ to 6′ 7″ but carries a prominent sandstone parting. Its areal extent, character, and quality, together with descriptions of openings and estimates of its available tonnage, will be discussed in Chapter XII under the subject of "Commercial Coal", and on Map II its outcrop is delineated in those localities where it is known or believed to be of minable thickness, and these areas are also shown on Figure 18.

DOTSON SANDSTONE.

The **Dotson Sandstone** of Campbell[8], named from its occurrence at Wyoming Station (formerly Dotson), Mingo

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[6]Ibid., p. 168.
[7]Ray V. Hennen and David B. Reger, Logan and Mingo Report, W. Va. Geol. Sur., pp. 221-222; 1914.
[8]M. R. Campbell, Tazewell Folio, No. 44, U. S. Geol. Sur., 1898.

County, has been traced northward across the State and was noticed at various points in Pocahontas County in those regions where its horizon occurs. It is a massive, gray, coarse stratum, frequently making bluffs and benches, and varying in thickness from 10 to 40 feet, and occurring 20 to 40 feet below the Gilbert Coal. It was noted on the waters of Middle Fork, Williams and Cranberry Rivers.

DOUGLAS COAL.

An opportunity was not afforded to examine the interval from the base of the Dotson Sandstone down to the top of the Upper Nuttall Sandstone. It is possible that this interval, varying from 10 to 25 feet, as shown in the general section, may contain the **Douglas Coal**. It is reported in the adjoining county of Webster as a 2- to 3-foot seam but of insufficient purity to be classed as an economic deposit of value. So far as the writer was able to determine this coal does not occur in this county.

DESCRIPTION OF MEMBERS, NEW RIVER GROUP OF POTTSVILLE SERIES.

The New River Group of Fontaine[9], or Middle Pottsville of White[10], named from its development along New River in Fayette and Raleigh Counties, West Virginia, comprises approximately the lower two-thirds of the Pottsville Series of Pocahontas County. It occupies the interval from the top of the Upper Nuttall Sandstone down to the top of the Mauch Chunk Series, as the Pocahontas Group of the Pottsville Series, which occurs in counties to the southwest, is entirely absent in Pocahontas County. Its occurrence is limited to the western part of the county along the drainage basins of Cherry, Cranberry, Middle Fork, Williams, Gauley, Elk, and Shavers Fork of Cheat Rivers. According to the general section it varies in thickness from 200 to 500 feet with a thinning to the north and east.

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[9]Wm. M. Fontaine, The "Great Conglomerate" on New River, West Virginia, Amer. Jour. Sci., third series, Vol. VII, 1874, pp. 459-465, 573-579. The Conglomerate Series of West Virginia, Amer. Jour. Sci., Vol. IX, 1876, pp. 276-284, 374-384.

[10]I. C. White, Vol. II(A), W. Va. Geol. Sur., p. 13, 1908.

UPPER NUTTALL SANDSTONE.

The **Nuttall Sandstone** of Campbell and White[11] and later termed the **Upper Nuttall Sandstone** by Hennen[12] for sake of convenience, and named from its occurrence along New River, Fayette County, between Nuttallburg and Gauley Bridge, where it is a conspicuous ledge coming a few feet above the massive Lower Nuttall Sandstone, and being the upper member of the New River Group, is found in Pocahontas County, although somewhat attenuated. It is a coarse, gray and brown sandstone making bluffs and benches and varying in thickness from 25 to 80 feet. It was noted on the waters of Cranberry River, Middle Fork, and Williams River.

LOWER NUTTALL SANDSTONE.

The **Lower Nuttall Sandstone** of Hennen[13], named from its association with the Upper Nuttall Sandstone in the New River gorge of Fayette County, is found in Pocahontas County in the region where its horizon outcrops and is the most prominent and conspicuous ledge in the Pottsville Series in this area. It is a massive, gray and white sandstone conglomerate, forming conspicuous cliffs along either side of the drainage basins of Cranberry River, Middle Fork, Williams and Gauley Rivers. It usually occurs near the tops of the ridges and often caps them, and in such places it is broken into great blocks with crevices large enough to permit narrow trails to pass through them. It varies in thickness from 50 to 70 feet.

HUGHES FERRY COAL.

The **Hughes Ferry Coal** of White[14], named from its occurrence at the Hughes Ferry bridge across Gauley River in Nicholas County, where it occurs only a few feet below the

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[11] M. R. Campbell, Raleigh Folio, No. 77, U. S. Geol. Sur., Dec., 1901. I. C. White, Bull. 65, U. S. Geol. Sur., p. 200, 1891; Vol. II, W. Va. Geol. Sur., pp. 616 and 665, 1903; and Vol. II(A), W. Va. Geol. Sur., pp. 253-254, 1908.

[12] Ray V. Hennen, Fayette Report, W. Va. Geol. Sur., p. 295, 1919.

[13] Ray V. Hennen, Fayette Report, W. Va. Geol. Sur., p. 297, 1919.

[14] I. C. White, Vol. II(A), W. Va. Geol. Sur., pp. 252-253, 1908.

great Lower Nuttall Sandstone, and believed by Hennen[15] to represent the **Iaeger Coal** of White,[16] was observed at several points in Pocahontas County. It is usually a soft, columnar coal, generally single-bedded, and varies in thickness from 1.5 to four feet, and comes a few feet below the Lower Nuttall Sandstone. The interval between the Hughes Ferry Coal and the Lower Nuttall Sandstone should contain the **Upper Iaeger Shale.** Its outcrop was not seen in Pocahontas County. A discussion of the character and areal extent, along with detailed bed sections and an estimate of tonnage for the Hughes Ferry Coal will be found in Chapter XII under the heading of "Commercial Coal". On Map II will be found its outcrop for the localities in which it is known or believed to be of minable thickness, and these areas are also shown on Figure 19.

HARVEY CONGLOMERATE.

The **Harvey Conglomerate** of Campbell[17], named from the town of Harvey (now Bolt P. O.), Raleigh County, where it occurs 50 to 100 feet below the Lower Nuttall Sandstone, was noted at a few points in extreme western Pocahontas County where its outcrop occurs. It is somewhat attenuated as compared to its type locality, being somewhat massive, gray or brown and coarse with occasional small pebbles but not being a marked conglomerate. In the general section its interval is noted as 5 to 10 feet below the Hughes Ferry Coal.

GUYANDOT SANDSTONE.

The **Guyandot Sandstone** of Campbell[18], named from its occurrence in Wyoming County, is also noted in Pocahontas and affords its best exposures in the southwestern part of the county. It is a coarse, gray or brown sandstone which weathers white and which varies in thickness from 15 to 25 feet. Its position is noted in the Briery Knob, Dogway, and Slaty Fork Sections.

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[15]Ray V. Hennen, Fayette Report, W. Va. Geol. Sur., p. 299, 1919.
[16]I. C. White, Vol. II(A), W. Va. Geol. Sur., pp. 251-252, 1908.
[17]M. R. Campbell, Raleigh Folio, No. 77, U. S. Geol. Sur., Dec., 1901.
[18]Ibid.

LOWER GUYANDOT SANDSTONE.

The **Lower Guyandot Sandstone** of Hennen[19], named from its occurrence in Wyoming and McDowell Counties, where it comes a few feet above the Sewell Coal, is present in Pocahontas County in the region of its outcrop. It is a coarse, massive, gray to white sandstone with fine white quartz pebbles and varies in thickness from 10 to 40 feet. It is usually separated from the Sewell Coal by 5 to 15 feet of shale, but occasionally rests upon the coal itself. Its outcrop is that of the Sewell Coal and can be located by following the latter outcrop on Map II.

HARTRIDGE BLACK SHALE.

The **Hartridge Black Shale** of Reger[20], named from its occurrence at the mining village of Hartridge, Randolph County, where it is characterized by **Naiadites elongata** fossils, was noted at a few points in Pocahontas. It is usually dark, argillaceous or carbonaceous and laminated, with frequent iron carbonate lenses. often contains plant or brackish-water fossils, varies in thickness from 5 to 15 feet, and occurs immediately above the Sewell Coal. Its outcrop is that of the Sewell Coal and can be located by following the latter horizon as delineated on Map II.

SEWELL COAL.

The **Sewell Coal** of White[21]. named from Sewell Mountain, Fayette County, and belonging in that locality about 300 feet below the Nuttall Sandstone and 60 to 80 feet above the Upper Raleigh Sandstone, is retained in Pocahontas County and is probably the most valuable of the New River coals. In this county its position varies from 100 to 250 feet above the base of the New River Group, and approximately 150 feet below the base of the Lower Nuttall Sandstone. It

[19]Ray V. Hennen, Wyoming and McDowell Report, W. Va. Geol. Sur., p. 196, 1915.

[20]David B. Reger, Barbour, Upshur and Western Portion of Randolph Report, W. Va. Geol. Sur., pp. 288-290, 1918.

[21]I. C. White, The Virginias, pp. 7-16, January, 1885; Bull. 65, U. S. Geol. Sur., p. 197, 1891; Vol. II, W. Va. Geol. Sur., pp. 657-665, 1903; and Vol. II(A), W. Va. Geol. Sur., pp. 199-241, 1908.

is usually soft and columnar and varies in thickness from 2 to 6 feet, but in this area often contains a bony parting which greatly impairs its value. It outcrops on Briery Knob, along Cranberry, Middle Fork, Williams, Gauley, and Shavers Fork of Cheat Rivers, and is usually of minable thickness. In the western side of the county its outcrop has been used as the base for the green structure contours shown on Map II, and on the same map its outcrop is delineated, and its minable areas are also shown on Figure 20. Its areal extent, character, with bed sections, chemical analyses, and an estimate of tonnage will be discussed in Chapter XII under the heading "Commercial Coal".

UPPER RALEIGH (SHARON) SANDSTONE.

The **Upper Raleigh Sandstone** of White[22], named from its occurrence in Raleigh County, remains a well-defined stratum in Pocahontas County. It is massive, gray to brown, coarse and pebbly and varies in thickness from 35 to 50 feet, its interval below the Sewell Coal being 25 to 50 feet and its outcrop being marked by frequent cliffs or bluffs. Due to its resistant character it is often found capping high knobs, as Big Spruce, Spruce, and Bald, as well as Red Lick Mountain, Thorny Flat, and others.

QUINNIMONT SANDSTONE.

The **Quinnimont Sandstone** of White[23], named from the town of Quinnimont, Fayette County, where it comes just under the Beckley Coal (not noted in Pocahontas), was observed at a few points in the county. In the Briery Knob Section this sandstone has a thickness of 55 feet, being brown, fine-grained, and cross-bedded. It is also noted in the Dogway Section. This stratum apparently disappears to the north as its outcrop was not apparent.

FIRE CREEK COAL.

The **Fire Creek (Quinnimont) Coal** of White[24], named from its occurrence in the vicinity of Fire Creek and Quinni-

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[22]I. C. White, Vol. II(A), W. Va. Geol. Sur., p. 198, 1908.
[23]Ibid., p. 13.
[24]I. C. White, Bull. 65, U. S. Geol. Sur., p. 197, 1891; and Vol. II(A), W. Va. Geol. Sur., pp. 179-185, 1908.

mont, Fayette County, where it has been mined on a commercial scale, still appears in Pocahontas County but is apparently too thin to be of any commercial value at the present time. It was noted at several points varying in thickness from 6 inches to two feet but was a single-bedded, clean coal.

PINEVILLE SANDSTONE.

The **Pineville Sandstone** of Hennen[25], named from its occurrence at Pineville, Wyoming County, where it comes directly above the No. 9 Pocahontas Coal, is the lowest member of the Pottsville Series definitely correlated in Pocahontas County, its position being a few feet below the horizon of the Fire Creek Coal. It was noted in the tributary branches of Cranberry River, particularly Lost Run. Its outcrop was not observed in the northern end of the county and hence it is apparently one of the members of this series that disappeared in the general northward thinning.

ECONOMIC ASPECTS, POTTSVILLE SERIES.

The coals of the Pottsville Series are its principal economic feature. In western Pocahontas County there appear to be three coals of minable thickness, but owing to their distance from the railroad and their height in the mountain, no attempt has been made to mine them on a large scale. That they will be mined at some future time is without doubt, but owing to the present condition of the coal market, along with many seams of greater thickness, better quality, and accessibility, their value is largely limited to local use.

Some of the massive sandstones could be used for masonry construction, but their location in the high mountain areas would make it difficult to market the finished product.

[25]Ray V. Hennen, Wyoming and McDowell Report, W. Va. Geol. Sur., pp. 211-12, 1915.

CHAPTER VII.

STRATIGRAPHY—MAUCH CHUNK SERIES.

GENERAL ACCOUNT AND SECTION, MAUCH CHUNK SERIES.

The Mauch Chunk Series, comprising the upper portion of the Mississippian Period or System and lying just beneath the Pottsville Series of the Pennsylvanian, forms the most extensive outcrop and is one of the most interesting series of this county. It was originally defined as the "Mauch Chunk Red Shale" by Ashburner[1] and this usage was followed by other members of the Second Geological Survey of Pennsylvania. The description of this formation as a simple shale at Mauch Chunk, a town in eastern Pennsylvania and its type locality, was proper since it there contains few bedded sandstones, no coals, and only occasional limestone, and this same simplicity continues southwestward across Maryland. In West Virginia, however, this condition rapidly changes from the northern end of the State to the southwest where it contains many heavy sandstones, frequent limestones, occasional streaks of coal, and a great variety in the shales. In recognition of these important variations and additions, Hennen[2] applied the word "Series" to include all the intervening strata between the Greenbrier Limestone and the Pottsville Series, and this more comprehensive usage has been generally employed in the West Virginia Reports. This same formation was described by Darton[3], in the Monterey Folio, embracing a part of this county, as the Canaan Formation. In southern West Virginia the complex nature of these rocks was recog-

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[1]C. A. Ashburner, Am. Phil. Soc. Proc., Vol. XVI, pp. 521, 536; 1877.
[2]Ray V. Hennen, Monongalia, Marion, and Taylor Report, W. Va. Geol. Sur., pp. 381-2; 1913.
[3]N. H. Darton, Monterey Folio, No. 61, U. S. Geol. Sur.; 1898.

nized by Campbell[4] and they were divided into logical groups, but at the same time their relationship to the Mauch Chunk of Pennsylvania was almost wholly ignored. In a recent report of the West Virginia Geological Survey, Reger[5] has definitely correlated these southern rocks with the Mauch Chunk Series and has been able to recognize many of the subdivisions of these groups over wide areas and has consequently given them suitable names. The grouping of Campbell, as amplified by Reger, is followed in this Report.

Pocahontas County is located approximately 100 miles northeast of the maximum development of the series but nevertheless retains in general the four major groups in somewhat attenuated form. Many of the minute subdivisions have been recognized throughout this area and where possible the same titles will be retained.

In this county the Mauch Chunk Series varies between 1,500 and 1,800 feet in thickness, the measurement of which often being made over a considerable distance, with rising or falling strata, affords opportunity for error, but corrections for these variations result in thicknesses near the truth. The exposures of this series are limited to the western side of the Greenbrier River and reach to the tops of many of the mountains. The following is a general section of the series for this area:

General Section of the Mauch Chunk Series for Pocahontas County, West Virginia.

	Thickness. Feet.	Total. Feet.
Bluestone Group (75-200′)		
Shale, red and green with occasional yellow or brown	75 to 200	200
Princeton Conglomerate (50-70′)		
Sandstone, Princeton, gray to brown, massive, coarse, very porous, with variegated pebbles and occasional plants	50 to 70	270
Hinton Group (500-700′)		
Shale, red and green	200 to 380	650
Sandstone, Goodwyn, red, shaly	10	660
Shale, Upper Goodwyn, dark, sandy, with marine fossils (Lot 60)	5 to 10	670

[4]M. R. Campbell, Pocahontas Folio, No. 26, U. S. Geol. Sur.; 1896.
[5]David B. Reger, Mercer, Monroe, and Summers Report, W. Va. Geol. Sur., pp. 293-301; 1926.

	Thickness. Feet.	Total. Feet.
Coal, Goodwyn, clean coal	0⅓ to 0	670
Shale, Lower Goodwyn, dark, with marine fossils (**Lot 60**)	10 to 30	700
Shale, red and variegated	150 to 220	920
Sandstone, Stony Gap (Hinton of **Stevenson)**, gray or white, coarse, massive, hard, and quartzitic	30 to 50	970
Bluefield Group (550-800′)		
Shale, red and variegated with occasional green	150 to 200	1170
Sandstone, Big Spruce Knob, (Graham?), greenish-gray, flaggy	15 to 25	1195
Shale, Big Spruce Knob, (Upper Graham?), gray, with plant fossils	2 to 0	1195
Coal, Big Spruce Knob, (Graham?), reported.	5 to 0	1195
Shale, red and green, with sandstone lenses	0 to 10	1205
Sandstone, Bertha, red and brown, lenticular	0 to 20	1225
Shale, Upper Bertha, red or brown, sandy	30 to 50	1275
Coal, lenticular, with plant fossils	0¼ to 0	1275
Shale, Lower Bertha, red or brown, sandy	15 to 20	1295
Sandstone, Bradshaw, green or brown, uneven-textured	20 to 40	1335
Shale, Bradshaw, red and variegated, containing the lenticular **Red Sulphur Coal** which has abundant **Calamites** with a few closely associated marine fossils	25 to 30	1365
Sandstone, Indian Mills, red and brown, with sandy shales near middle	10 to 30	1395
Shale, Indian Mills, red, blue, gray, or green and sandy, with scattered fossil pits	50 to 70	1465
Coal, Raines Corner, streak, with plant fossils	0½ to 0	1465
Shale, Possumtrot, red, yellow, or green, sandy	30 to 40	1505
Sandstone, Droop, white, medium-grained, soft, weathering into white sand; caps Droop Mountain (type locality)	40 to 50	1555
Shale, Ada, green and sandy near top, variegated toward base, with marine fossils	20 to 30	1585
Limestone, Reynolds, gray, shaly at top, massive at base, with fish teeth and a profuse marine fauna, **Orthotetes, Composita, Productus. (See Lots 9, 23, 33, 38, and 56)**	25 to 30	1615
Shale, Bickett, red and green	20 to 30	1645
Sandstone, Webster Springs, reddish-brown, shaly	0 to 10	1655
Limestone, Glenray, hard, impure, shaly, with numerous marine fossils. **(See Lots 17 and 18)**	0 to 15	1670
Shale, Lillydale, greenish-gray to dark at top, black, carbonaceous and fissile at base, with occasional thin limestones containing marine fossils	30 to 50	1720
Sandstone, Edray, brown, flaggy, calcareous; makes prominent ledge at Slaty Fork	0 to 50	1770
Greenbrier Series		

SUBDIVISIONS, MAUCH CHUNK SERIES.

The rocks now known to compose the Mauch Chunk Series of southern West Virginia were subdivided in 1896 by Campbell[6] into the following four major groups:

Bluestone Formation (Group)
Princeton Conglomerate
Hinton Formation (Group)
Bluefield Shale (Group).

The term "Formation" was appended to the Bluestone and Hinton divisions and the basal member was called "Bluefield Shale". Reger[7] has subsequently studied these beds in detail and has replaced the terms "Formation" and "Shale" by "Group" which seems to be well adapted to these formations in Pocahontas County. The subdivisions are easily recognized and the later usage is consequently followed in this report.

TOPOGRAPHIC EXPRESSION, MAUCH CHUNK SERIES.

The topographic relief of the Mauch Chunk Series where it has not been influenced by the overlying Pottsville Series is usually that of broad level ridges with comparatively steep slopes, made up of two or more benches. From the flat tops of these ridges the slope is steep until another resistant sandstone interrupts the steep angle and forms a bench or in some cases another flat ridge. This is very noticeable along the headwaters of Cranberry and Williams Rivers, but is best developed along and between the headwaters of Elk River and the Greenbrier drainage. The best examples of topography as expressed by this series are Droop Mountain, Spruce Flats, Stony Creek Mountain, Cloverlick Mountain, Slaty Ridge, Buzzard Ridge, and the region around Gay and Moffett Knobs.

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[6]M. R. Campbell, Pocahontas Folio, No. 26, U. S. Geol. Sur.; 1896.
[7]David B. Reger, Mercer, Monroe, and Summers Report, W. Va. Geol. Sur., p. 304; 1926.

AREAL EXTENT, MAUCH CHUNK SERIES.

Figure 6, shows at a glance the outcrop of this series in Pocahontas County, while on Map II the same outcrops are delineated in much greater detail. By this figure and map it is evident that approximately 25 per cent. of the surface rocks of the county are of the Mauch Chunk Series. A further examination of Figure 6 and Map II reveals that this series is limited to the western portion of the county, being entirely west of the Greenbrier River and comprising all that area west of the Greenbrier Limestone belt with two exceptions, that is, the areas covered by the Pottsville Series as seen on Figure 5 and the narrow belt along the valley floor of Elk River and its main tributaries in Pocahontas County.

CONTACTS, MAUCH CHUNK SERIES.

The contact of the Mauch Chunk Series with the overlying Pottsville Series and the unconformity that exists between them, have been discussed under the description of the latter series. At the base of the Mauch Chunk Series there is not the marked contrast with the underlying Greenbrier Limestone Series as there is with the overlying Pottsville, but the contact is one of gradual change rather than an abrupt break. Considering the two series as a whole there is a large difference, the Mauch Chunk consisting mainly of red shales and sandstone with occasional thin streaks of coal and with the basal portion carrying thin limestones and shales, while the Greenbrier Series is made up almost entirely of massive limestones. At the contact, however, the two series blend together lithologically as well as paleontologically as will be discussed under the following heading.

FOSSIL LIFE, MAUCH CHUNK SERIES.

In the Mauch Chunk Series the fossils have changed materially from reptile tracks and vertebrate remains, at its type locality, to a fauna composed almost entirely of marine shells with an occasional fish tooth, along with a variety of

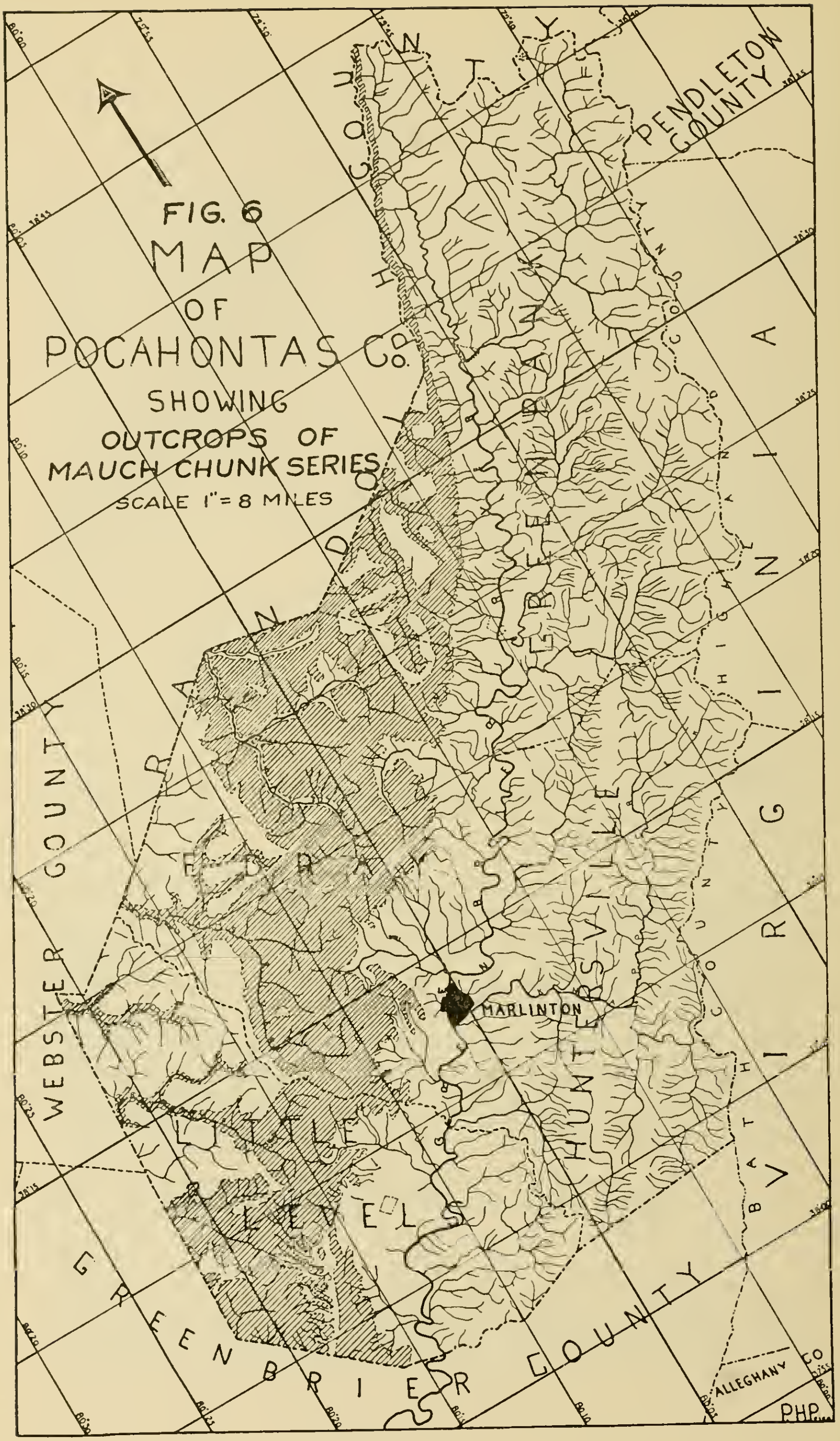

FIG. 6
MAP
OF
POCAHONTAS Co.
SHOWING
OUTCROPS OF
MAUCH CHUNK SERIES
SCALE 1" = 8 MILES
PENDLETON COUNTY
HIGHLAND COUNTY
RANDOLPH COUNTY
WEBSTER COUNTY
GREENBRIER COUNTY
BATH COUNTY
ALLEGHANY CO
VIRGINIA
MARLINTON
LITTLE LEVELS
HUNTERSVILLE
GREENBANK
EDRAY
P.H.P.

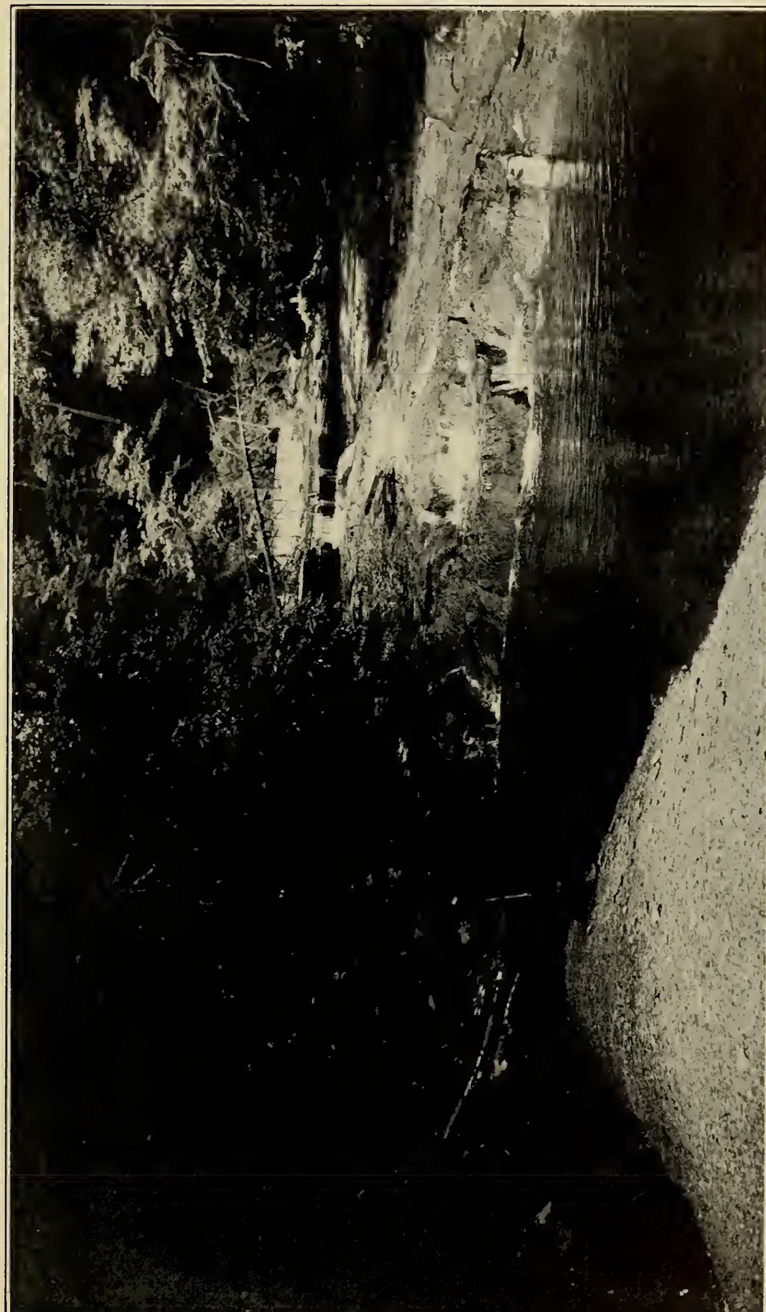

PLATE XIX.—Right Fork of Tea Creek passing over the Princeton Sandstone to form a small falls and an excellent pool for trout. (Photo. by Paul H. Price).

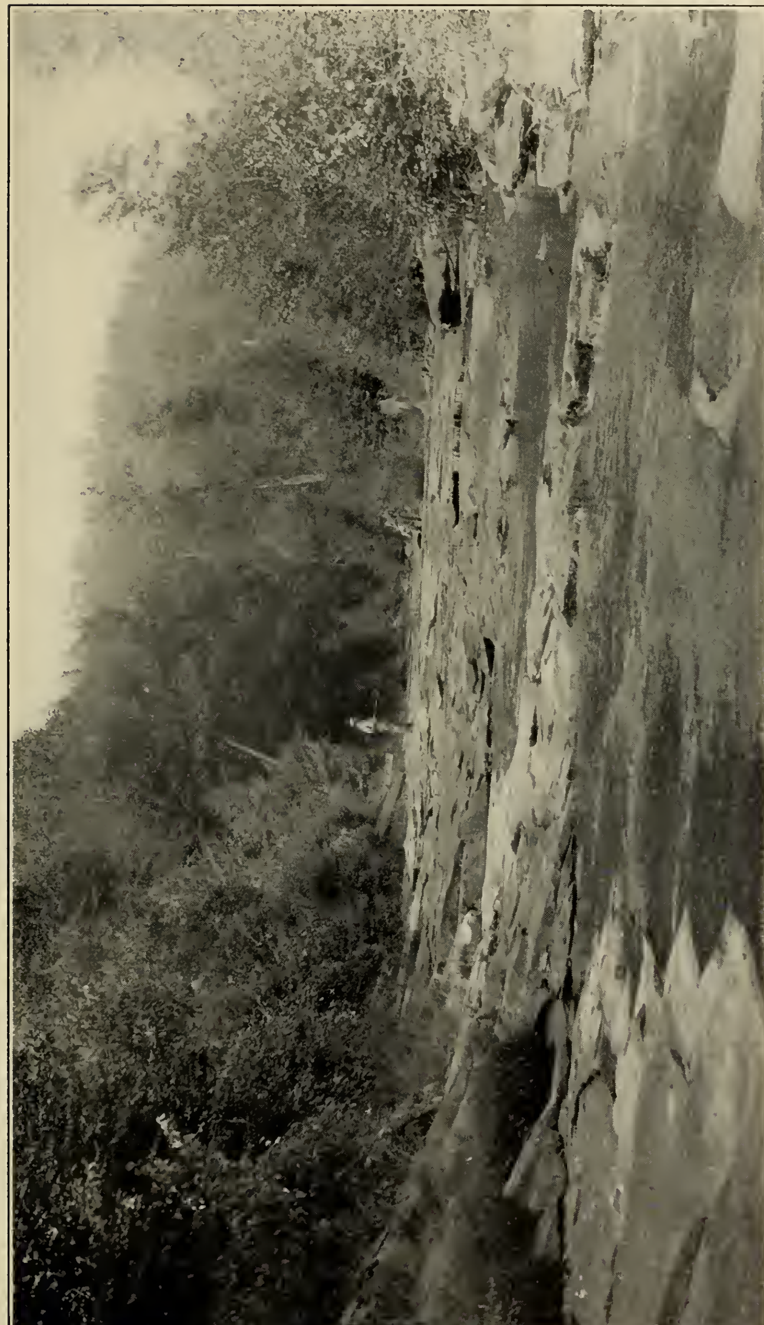

PLATE XX.—Princeton Conglomerate exposed for about one mile in bed of North Fork of Cranberry River beginning ½ mile above its mouth. (Photo. by Paul H. Price).

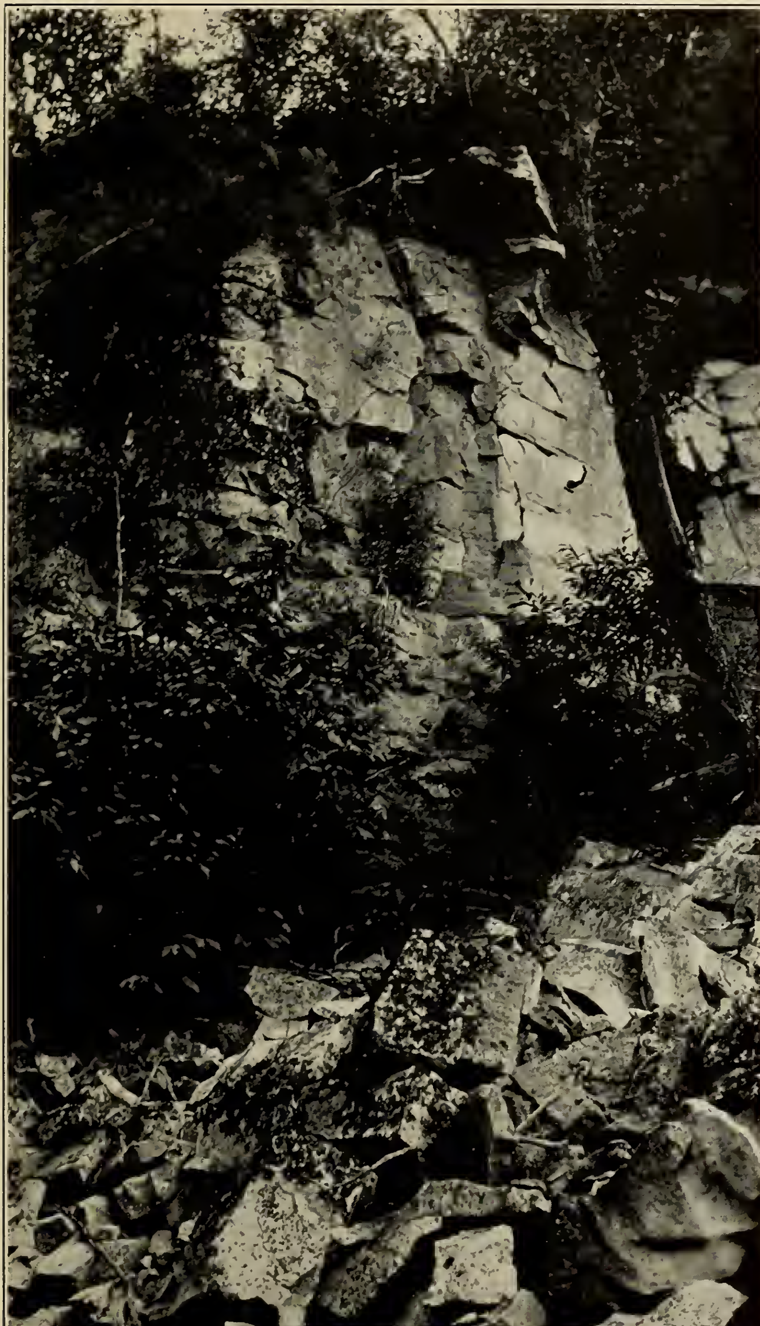

PLATE XXI.—Massive Droop Sandstone of Mauch Chunk Series seen on north end of Droop Mountain 2½ miles northeast of Lobelia. The talus is known locally as "Rattlesnake den". (Photo. by Paul H. Price).

PLATE XXII.—Falls of Hills Creek. Lower Fall. Mountain stream passing over one of the Mauch Chunk cross-bedded sandstones, 3½ miles northwest of Lobelia. (Photo. by Paul H. Price).

fossil plants. The fossils are distributed throughout the series but increase in number toward the base. No attempt was made to get a complete assemblage from this series, but a few collections were made at exposures where the fossils were well weathered out. These collections were studied by Dr. John L. Tilton and their identification with comment will be found in Chapter XV under the heading Notes on Paleontology. Several loose specimens of **Stigmaria** were collected but none of these appears under this heading. The collections from this series were made primarily from the basal portion and belong in the Reynolds and Glenray members. (See **Lots 60, 9, 23, 33, 38, 56, 17,** and **18**).

During the summer of 1920 three collections were made from the basal Mauch Chunk Series by Dr. George H. Girty, of the U. S. Geological Survey, and Dr. Wm. Armstrong Price, (at that time Paleontologist for the W. Va. Geological Survey) in the vicinity of Mill Point, and the identifications along with descriptions and comment by Dr. Girty were published as a part of the Tucker County Report[8]. As these collections were made in Pocahontas County it is deemed advisable to publish Dr. Girty's identifications, and comments upon them here, the same being as follows:

Lot 3287.—Old lumber railroad up Stamping Creek, northwest of Mill Point. From a thin limestone 157 feet above the top of the Greenbrier Limestone. (The interval seems somewhat too large but is apparently from the Reynolds Limestone horizon of this report.—P. H. P.)

Fistulipora excellens var. Harrisonensis
Stenopora sp.
Fenestella tenax
Fenestella serratula
Archimedes Meekanus
Rhombopora sp.
Streblotrypa subspinosa
Orthotetes Kaskaskiensis
Productus ovatus
Diaphragmus elegans
Spirifer Leidyi
Spirifer increbescens
Spiriferina spinosa
Composita subquadrata
Leda aff. nasuta
Parallelodon sp.
Schizodus depressus var. abruptus
Aviculipecten aff. Tahlequahensis

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[8]Tucker County Report, W. Va. Geol. Sur., pp. 449-488; 1923.

Deltopecten aff. Ozarkensis
Orthoceras aff. epigrus.

"Another calcareous horizon about 100 feet above the top of the Greenbrier gave the following species:

"**Lot 3294.**—Old lumber road up Stamping Creek northwest of Mill Point. (Reynolds Limestone.—P. H. P.)

Triplophyllum sp.
Fenestella serratula
Orthotetes n. sp.?
Productus ovatus
Diaphragmus elegans
Dielasma Arkansanum
Spirifer Breckenridgensis
Spirifer Leidyi
Spirifer increbescens
Spiriferina spinosa
Martinia sulcata
Composita subquadrata
Sphenotus? sp.
Aviculipecten inspeciosus
Myalina Sanctiludovici ?

"In this fauna one may note the differentiation of the Spirifers among which it is practicable to distinguish three types, as above recorded, and also the abundance of Martinias. Martinia is not confined to the Mauch Chunk, but at some points, as at this one, it appears with striking profusion in the lower part of the formation.

"From 7 feet of limestone and shale about 85 feet above the top of the Greenbrier we collected the following (**Lot 3286**):

"**Lot 3286.**—Old lumber railroad up Stamping Creek northwest of Mill Point, 85 feet above the top of the Greenbrier Limestone. (Glenray Limestone.—P. H. P.)

Pentremites aff. Girtyi
Stenopora sp.
Orthotetes Kaskaskiensis
Productus ovatus
Diaphragmus elegans
Spirifer increbescens
Spirifer Leidyi?
Composita subquadrata ?
Cliothyridina sublamellosa
Eumetria Verneuiliana
Sphenotus ? sp.
Aviculipecten inspeciosus
Aviculipecten aff. Mayesensis
Leptodesma ? sp.
Sulcatipinna Missouriensis
Bellerophon aff. sublevis
Platyceras aff. subrotundum
Giffithides sp.

"This fauna requires no comment. Pentremites were fairly abundant but the specimens collected were more or less fragmentary. They show a large form (if there is but one) having an elongate shape and deeply concave ambulacral areas."

The types of fossils found in the limestone at the base of the Mauch Chunk do not show the striking contrast that one would expect in passing from a series which is predominantly calcareous to one which is predominantly argillaceous, as will be seen from Dr. Girty's collections from the underlying Greenbrier Series near the same locality. (See Fossil Life of Greenbrier Series).

CORRELATION, MAUCH CHUNK SERIES.

The Mauch Chunk Series from its type locality in eastern Pennsylvania, southwestward into West Virginia, has been generally recognized as such (No. XI of the early Rogers' classification) save in a few localities where the name "Canaan Formation" has been used. From southern West Virginia northeastward across Pocahontas County the four major groups have been traced but in the extreme northern end of this county the series thins rapidly and the respective groups are less evident.

DESCRIPTION OF MEMBERS, BLUESTONE GROUP.

Due to the position of this group, directly under the Pottsville Series, no exposures were found suitable for detailed subdivision. Its outcrops, well up on the mountainsides, are invariably covered with a heavy talus from the overlying rocks, and located in timbered regions so that no detailed sections are available. This interval is apparently occupied by red and green sandy shales with occasional streaks of yellow or brown.

DESCRIPTION OF MEMBERS, PRINCETON CONGLOMERATE.

PRINCETON SANDSTONE.

The **Princeton Conglomerate**, or **Princeton Sandstone**, for in some localities it has been described as containing no pebbles, is, in Pocahontas County, one of the prominent markers and the best key rock in the Mauch Chunk Series. In this area it is only a single member, being very coarse, brown but weathering white, and massive, pitted or honeycombed on exposure. It contains abundant pebbles varying from the size of sand grains to small boulders as much as three inches in diameter, which are white, black, and sometimes pink. In this latter respect it differs from the Pottsville conglomerates whose pebbles are invariably white. Occasionally the basal portion contains limestone pebbles and has the appearance of a breccia. So far as known it contains no marine fossils but does contain poorly preserved branches of plants. It varies in thickness from 50 to 70 feet.

The Princeton Conglomerate is well exposed in the western part of the county and is often seen making cliffs and falls, and it forms the beds of streams for considerable distances. Its best exposure is along Williams River immediately east of the Webster County line and it remains above drainage, just above the river bed, for several miles. It can be seen under like conditions along Cranberry River, and is exposed in the bed of North Fork of Cranberry for a distance of one-half mile beginning one-fourth mile above its mouth. (Plate XX). Due to its resistant character it often makes falls where it is crossed by streams and such is case at the forks of Tea Creek, (Plate XIX), Tumbling Rock Run, and others.

The detailed occurrence of the Princeton Conglomerate may be seen on Map II where its position is delineated.

DESCRIPTION OF MEMBERS, HINTON GROUP.

The upper 200 to 380 feet of the Hinton Group is composed of variegated shales which are predominantly red but their correlation with the minor subdivisions of southern West Virginia can not be definitely determined until the intervening county of Greenbrier is worked in detail.

GOODWYN SANDSTONE.

The **Goodwyn Sandstone** of Reger[9], named from its occurrence on Fivemile Creek at Goodwyn Chapel, Mercer

[9]David B. Reger, Mercer, Monroe, and Summers Report, W. Va. Geol. Sur., p. 358; 1926.

County, where it is described as being greenish-gray and massive, or reddish-brown and shaly, is present in Pocahontas County. It is noted in the Edray Section where it is described as being red and shaly with a thickness of 10 feet.

UPPER GOODWYN SHALE.

The **Upper Goodwyn Shale** of Reger[10] is also present in Pocahontas County and is noted in the Elklick Run Section, where it is described as a brown, yellow and sandy fissile shale with marine fossils. Here the following section was noted:

Local Measurement at Fossil Lot 60.

Edray District, along Elklick Run 2.25 miles northwest of Stony Bottom; elevation, 4,200′ B.

	Thickness. Ft.	In.	Total. Ft.	In.
Concealed				
Shale, Upper Goodwyn, brown or yellow, sandy, fissile	10	0	10	0
Coal, Goodwyn, clean	0	4	10	4
Shale, Lower Goodwyn, gray or dark, fissile, with marine fauna; pelecypods (See Lot 60)	9	8	20	0
Concealed				

GOODWYN COAL.

It is possible, but not altogether certain, that a coal occurring at this horizon in the Elklick Section is continuous with "a dark bituminous bed" described by Reger[11] at Goodwyn Chapel on Fivemile Creek, Mercer County, as the **Goodwyn Coal.** The coal which appears at this horizon in Elklick Run northeast of Stony Bottom and noted in the above section is, however, temporarily correlated as the Goodwyn Coal because of its association with the overlying and underlying shales containing a marine fauna (See Lot 60) with very abundant **Allorisma.** Here the section shows four inches of clean coal.

LOWER GOODWYN SHALE.

The **Lower Goodwyn Shale,** named by Reger[12] from its occurrence at Goodwyn Chapel on Fivemile Creek, Mercer

[10] Ibid., p. 359.
[11] Ibid., p. 360.
[12] Ibid., p. 360.

County, where it is described as being a dark calcareous bed, with marine fossils near the top, and red and variegated with streaks of sandstone near the base, is apparently present in Pocahontas County. In the Elklick Run Section a gray and dark fissile shale coming below the Goodwyn Coal, and containing numerous marine fossils, is temporarily correlated with the Lower Goodwyn Shale of Mercer County. Here the upper portion only is exposed and has a thickness of 10 feet.

STONY GAP SANDSTONE (HINTON of Stevenson).

The **Stony Gap Sandstone** of Reger[13] or **Hinton** of Stevenson is present in Pocahontas County and forms the basal member of the Hinton Group. This sandstone was recognized many years ago as an important key rock and was called the Hinton Sandstone by Dr. John J. Stevenson from its exposure near Hinton, Summers County, but apparently little recognition was given it. Later Campbell[14] applied the term "Hinton Formation" to a major group of rocks in the New River Valley, and its usage has become so well fixed in the geologic literature of Virginia and West Virginia that it appears unwise to return to the earlier application, which would possibly lead to confusion. Reger has accordingly renamed this horizon the Stony Gap Sandstone from its occurrence at the village of that name in Mercer County, where it is well exposed. At its type locality it is described as being a light-gray or white, massive, coarse, and extremely hard and quartzitic ledge, varying in thickness from 35 to 85 feet.

In Pocahontas County this sandstone retains its same general character, being a gray to white, medium-grained, massive, hard and quartzitic sandstone, but attaining no thickness greater than 50 feet. Its position can be noted in the measured sections containing the Mauch Chunk Series and located in greater detail from Map II as it forms the basal member of the Hinton Group which is thereon delineated. A good exposure is afforded on the Staunton and Parkersburg Pike at the summit of the divide between Pocahontas and Randolph Counties. Because of its resistant

[13]David B. Reger, Mercer, Monroe, Summers Report, W. Va. Geol. Sur., pp. 371-378; 1926.

[14]M. R. Campbell, Pocahontas Folio, No. 26, U. S. Geol. Sur.; 1896.

character it forms benches or flats in the topography and can be seen near the headwaters of Elk on either side of the valley, well up on the mountains, and also along the waters of Laurel Creek of Williams River. It is separated from the member last described by 150 to 220 feet of red and variegated shale.

So far as known no use has been made of this stratum for any purpose, but owing to its resistant character, its purity, and its pleasing appearance, it should be suitable for building stone and other local uses.

DESCRIPTION OF MEMBERS, BLUEFIELD GROUP.

The Bluefield Group makes the largest single subdivision of the Mauch Chunk Series and because of its position and distribution throughout the county affords the best opportunity for detailed study. Until Reger's recent detailed studies of these beds in southern West Virginia, only a few of the minor subdivisions in surrounding areas had been named. In this report[15] numerous members were assigned new names. So far as is applicable these new titles have been used in this volume. In the lower portion of the Bluefield Group there is a great similarity in the fossil fauna with that of the Chester Series of Kentucky, Missouri, and Illinois, where these formations have been studied in great detail. It is possible that in the near future paleontologists with the aid of stratigraphers may establish definite correlations. Many of these have in fact been suggested by Reger.

The upper 150 to 200 feet of the Bluefield Group is composed of variegated shales which are predominantly red, so that subdivisions are of little importance.

BIG SPRUCE KNOB (GRAHAM) SANDSTONE.

The **Big Spruce Knob Sandstone** was named by Reger[16] from its occurrence near the base of Big Spruce Knob in

[15]David B. Reger, Mercer, Monroe, and Summers Report, W. Va. Geol. Sur.; 1926.

[16]David B. Reger, Webster County Report, W. Va. Geol. Sur., pp. 221-223; 1920.

Pocahontas County, where it is a greenish-gray, flaggy stratum, approximately 30 feet thick. Along the valley near the headwaters of both Williams and Cranberry Rivers this ledge makes prominent cliffs. In his Mercer County Report Reger has provisionally correlated this sandstone with the **Graham Sandstone** of that area. At its type locality the Big Spruce Knob Sandstone contains plant remains, a collection of which, made by Reger, was forwarded to Dr. David White, of the U. S. Geological Survey, who is one of the foremost authorities on paleobotany. Because the collection was made in the area under discussion in this report, his interesting comment, previously published in the Webster County Report of the Survey, pages 222-223, is herein republished as follows:

"DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY
WASHINGTON

June 1, 1918.

"Dr. I. C. White, State Geologist,
West Virginia Geological Survey,
Morgantown, W. Va.

"Dear Doctor White:

"The Calamarian fragments from the Mauch Chunk Shale series 1270 feet below the base of the Pottsville, and 832 feet above the top of the main base of the Greenbrier Limestone at a coal prospect about 8 miles northwest of Marlinton, in Pocahontas County, West Virginia, collected by Mr. D. B. Reger and forwarded in accordance with your letter of May 14, have been examined with great interest.

"The pith casts show the node features and continuity of the ribs, characteristic of **Asterocalamites scrobiculatus** (formerly **Bornia radiata**), in form as nearly typical as I have yet seen from the Mississippian. The internodes are a little short but the narrowness and transversely linear character of the constriction, as though the pith had been slightly drawn by a thread encircling it, are typical of this species. On the other hand, most of the specimens which have been described and even recorded in the paleobotanical literature of this country are far from typical. Some of the specimens have been found upon examination to represent types with thin cortical and woody zones with predominant alternation of the ribs at the nodes. On the whole, the records in our literature of the distribution of **Asterocalamites** in the States, and in fact all North America, are very unreliable.

"Is it not possible that the zone of thin coals resting on old soils with land plants from which these fossils were obtained may be the same as that found to carry coals, coaly streaks, or soils and land plant remains near the old Abbs Valley Station on the Norfolk & Western R. R. between Bluefield and Bluestone Junction, and below the southeast escarpment of the coal field 10 or 15 miles east or northeast of Webster Springs? As a working hypothesis at least does it not seem reasonable to assume that this region of uplift and exposure is rather extensive in the central Appalachian Valley, and that the diastrophic movement may be found to constitute a significant and possibly reliable feature of the stratigraphy and of Mississippian history in the Appalachian region?

"From several localities in western Kentucky, Mr. Chas. Butts collected, in a sandstone, plant remains almost certainly contemporaneous with those found in the cut at Abbs Valley, Va. Evidence also points toward possible contemporaneity of plant-bearing sandstones in Alabama.

"Were there no small fragments of a small species of **Cadiopteris** found associated with the coal? Surely fragments of some sort of fernlike plants should be found.

"On rereading the letter I notice that the last paragraph refers to the Pluto Coal found by Mr. Reger in northeastern Webster County. You evidently have the same idea as that above regarding the continuity and significance of a persistent coal horizon in this zone of the Mauch Chunk.

"Thanking you for the privilege of examining the specimens, which I return to you under separate cover, I am, with best regards,

"Very truly yours,

(Signed) DAVID WHITE, Chief Geologist."

BIG SPRUCE KNOB SHALE.

The **Big Spruce Knob Shale**, named by Reger[17] from its occurrence and position between the Big Spruce Knob Sandstone and Big Spruce Knob Coal, on Williams River near the base of this knob, is a gray argillaceous stratum of only a few feet in thickness. Its interest is limited to its association with the underlying coal. The idea has been suggested by Reger that this member is the same as the **Upper Graham Shale** of his Mercer Report.

BIG SPRUCE KNOB COAL.

The **Big Spruce Knob Coal**, named by Reger[18] from its occurrence on Big Spruce Knob near the headwaters of Williams River, is described as a carboniferous stratum that occurs at an approximate interval of 700 feet below the base of the Princeton Conglomerate, and 832 feet above the top of the Greenbrier Limestone as recorded in the Pocahontas County Coal and Land Company test well. Unfortunately at the time of the writer's studies in this county as well as at the time of Reger's visit the opening had fallen shut and

[17]Ibid., pp. 223-4.
[18]Ibid., pp. 224-225.

a personal examination was not possible. The following section of the coal was reported by Mr. Hubert Echols, of Marlinton, an officer of the company on whose land the opening is located:

Pocahontas County Coal and Land Company Prospect—No. 18 on Map II.

Edray District, on Williams River, southwest base of Big Spruce Knob, 6.5 miles northwest of Marlinton; **Big Spruce Knob Coal**; elevation, 3615′ B.

		Ft.	In.
Sandstone, Big Spruce Knob		30	0
Shale, Big Spruce Knob, gray, 2′ to		0	0
Coal	1′ 10″		
Parting	1 6	4	10
Coal	1 6		

At the time of Mr. Reger's visit to the prospect some oxidized coal fragments found on the dump were collected (Sample No. 4Rc) and showed the following contents as analyzed by Hite and Krak:

	Per cent.
Moisture	0.91
Volatile Matter	25.81
Fixed Carbon	38.29
Ash	34.99
Total	100.00
Sulphur	2.78
Phosphorus	0.040

After a detailed study of the rocks of this group in Pocahontas County and finding no similar development of coal at this horizon, the writer is of opinion that this deposit represents a lens or local development and will not be of sufficient economic value to warrant extensive prospecting. While it is of considerable scientific interest, the possibility of the blossom developing into a commercial seam of coal is highly improbable. Reger, as expressed in his Mercer Report, is of opinion that the Big Spruce Knob Coal is probably equivalent to the **Graham Coal** of the southern counties, this latter coal being also a lenticular and worthless deposit.

BERTHA SANDSTONE.

The **Bertha Sandstone**, named by Reger[19] from its occurrence near Bertha, Summers County, where it is greenish-gray and shaly, varying in thickness from 30 to 50 feet, is apparently present in Pocahontas County. A sandstone occurring at this horizon in the Edray Section and described as gray or green and lenticular but partly massive with a thickness of 20 feet, is believed to correspond to the Bertha Sandstone of Reger.

UPPER BERTHA SHALE.

A shale along the new State road north of Edray, coming just beneath the sandstone which has been correlated as the Bertha, is probably the same as the **Upper Bertha Shale** of the Mercer, Monroe, and Summers Report and is correlated as such. Here it is a red and brown, sandy deposit, occurring in lenses and having a thickness of 45 feet.

LOWER BERTHA SHALE.

The **Lower Bertha Shale**, named by Reger[20] from its association with the other members of the Bertha stage in Summers County, is apparently present in Pocahontas County and might be considered as a part of the overlying shale except for the presence of a thin coal seam separating the two. Its position in the series can be seen in the Edray Section on page 93, and at a point along the new State road northwest of Edray the following section was noted:

	Thickness. Ft.	In.	Total. Ft.	In.
Sandstone, Bertha, gray or green, lenticular, but partly massive	20	0	20	0
Shale, Upper Bertha, red or brown, sandy, lenticular	45	0	65	0
Coal, lenticular, with plant fossils	0	3	65	3
Shale, Lower Bertha, red or brown, sandy	20	0	85	3

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[19]David B. Reger, Mercer, Monroe, Summers Report, W. Va. Geol. Sur., pp. 391-392; 1926.

[20]Ibid., p. 394.

BRADSHAW SANDSTONE.

The **Bradshaw Sandstone**, named by Reger[21] from its occurrence in the vicinity of Indian Mills, along Bradshaw Creek, Summers County, is described as a greenish-gray, shaly or massive, medium-grained ledge, varying in thickness from 30 to 50 feet. A sandstone which occurs at this approximate horizon along the new State road north of Edray, and being a green, brown, uneven-textured and shaly stratum, probably corresponds to the Bradshaw Sandstone of Reger.

BRADSHAW SHALE.

The **Bradshaw Shale**, named by Reger[22] from its occurrence along the mountain road north of Indian Mills, Summers County, where it is usually a red and variegated, but sometimes green and sandy deposit, has also been recognized in Pocahontas County. Here the shale is red and variegated, with a coal lens at its top containing both plant fossils **(Calamites)** and marine fossils (pelecypods). Because of the apparent similarity of these beds to those described by Reger in Summers County, this shale is regarded as corresponding to the Bradshaw Shale, and if so, the associated coal would be the **Red Sulphur**.

INDIAN MILLS SHALE.

The **Indian Mills Shale**, named by Reger[23] from its occurrence just west of Indian Mills, Summers County, and described as a green or red and variegated deposit varying in thickness from 60 to 70 feet and having frequent marine fossils and occasional plant fossils, is present in Pocahontas County. Along the new State road north of Edray the following section was measured and is believed to correspond to the Indian Mills Shale:

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[21]Ibid., pp. 394-395.
[22]Ibid., pp. 398-399.
[23]Ibid., pp. 401-404.

	Thickness. Ft.	In.	Total. Ft.	In.
Shale, red	40	0	40	0
Shale, blue, gray and red, fossiliferous zone; pelecypods	1	6	41	6
Shale and sandstone, with scattered fossil pits	20	6	62	0
Shale, red, green and sandy	20	0	82	0

RAINES CORNER COAL.

The **Raines Corner Coal** of Reger[24] is described as being a persistent, carbonaceous horizon, usually slaty and impure, and varying in thickness from one to two feet, at its type locality at Raines Corner, Monroe County. A coal occurring at this horizon along the new State road north of Edray is probably of the same age. Here the coal is impure and slaty, with plant fossils, and has a thickness of six inches, and occurs immediately under the Indian Mills Shale.

POSSUMTROT SHALE.

The **Possumtrot Shale**, which is described by Reger as occurring just below the Raines Corner Coal in Monroe County, appears to be represented by a bed of red, yellow or green, sandy shale 30 to 40 feet thick, as indicated in the General Section of the Mauch Chunk Series, pages 140-1.

DROOP SANDSTONE.

The **Droop Sandstone** was named by Reger[25] from its occurrence on Droop Mountain, Pocahontas County. Here this sandstone makes the flat surface of Droop Mountain for several miles and its upper surface has so weathered as to cover the top of the flat with white sand. Here, at its type locality, it attains a thickness of 40 to 60 feet, being a massive, medium- to fine-grained, usually white but often brown sandstone which occasionally contains streaks of pink sand. On the eastern side of Droop Mountain it has broken into huge blocks causing travel among them to be very treacherous. At one point the talus is so arranged as to permit the accumulation of snow and ice which remains un-

[24]Ibid., pp. 410-414.
[25]Ibid., pp. 415-418.

melted throughout the year and it is known locally as "Ice Cave". On the western side of Droop Mountain massive ledges are seen along the road west of Spice P. O. to Lobelia (See Plate LIII) and in the vicinity of Viney Mountain between Lobelia and Hillsboro (Plate XXI).

The Droop Sandstone attains its greatest development in the vicinity of Droop Mountain and is apparently confined to the southern half of Pocahontas County as its outcrop was not noted north of Marlinton.

So far as known no use has been made of this stratum other than for road construction, for which it makes an excellent base when secured from unweathered outcrops. Samples (Nos. 53 and 64) of this rock were taken on Droop Mountain for chemical analysis the results of which show it to be a remarkably pure sand, as will be recorded in Chapter XIV.

ADA SHALE.

The **Ada Shale** of Reger[26], named from its occurrence between Ada and Stony Gap, Mercer County, is present in Pocahontas County, occurring between the Droop Sandstone and the Reynolds Limestone, and was noted in the Droop Mountain and Edray Sections. At the former place the following section was measured:

Local Measurement of Ada Shale.

Little Levels District; along new State road on Droop Mountain, 0.4 mile northeast of Spice P. O.

	Thickness. Feet.	Total. Feet.
Shale, partly concealed, but greenish.........	50	50
Shale, dark, fissile, with scattered septarian nodules, which when broken reveal fissures filled with calcite..........................	10	60

At certain localities this shale contains numerous marine fossils.

REYNOLDS LIMESTONE.

The **Reynolds Limestone** was named by Reger[27] from its occurrence in Monroe County 0.3 mile east of Reynolds

[26]Ibid., pp. 421-426.
[27]Ibid., pp. 426-430.

School, where it is a gray, shaly bed usually 10 to 15 feet in thickness, coming under the Ada Shale, and being rich in marine fossils. This same horizon continues northward and is well developed, and is one of the best key rocks in Pocahontas County. In this area it was noted at most points in which its outcrop should occur, being a series of thin shaly limestones alternating with gray shale in the upper portion and becoming more massive at its base, with profuse marine fossils throughout. **Orthotetes, Composita,** and **Spirifer** are very common, associated with gastropods and bryozoa and an occasional fish tooth. Because of its shaly character the fossils weather out readily making this horizon a choice collecting ground. Numerous collections were made from this horizon **(Lots 9, 23, 33, 38, 56),** the identifications of which by Dr. Tilton appear in Chapter XV. Other collections made by Dr. Girty and Dr. Wm. Armstrong Price and appearing under "Fossil Life of Mauch Chunk Series", pages 143-7, of this report, probably came from this horizon.

A good exposure of the Reynolds Limestone can be seen along the new State road north of Edray, (See Plates XXIV and XXV), where the following section was measured:

Local Measurement, Reynolds Limestone.

Edray District; along new State road 1.1 miles north of Edray; base 130 feet above top of Greenbrier Limestone.

	Thickness. Feet.	Total. Feet.
Limestone, with blue and gray calcareous shale, and with profuse marine fossils, **Orthotetes, Composita, Productus,** etc.......	10	10
Limestone, grayish-blue, weathers yellow (**Lot 9**)..	10	20
Limestone, thin, with gray shales, and with profuse fauna, **Orthotetes, Productus,** fish tooth, etc.	10	30

The Reynolds Limestone is also well exposed along the new State road ascending Droop Mountain, 0.5 mile northeast of Spice Post-Office, where the following section was measured:

Local Measurement, Reynolds Limestone.

	Thickness. Feet.	Total. Feet.
Limestone, dark, fossiliferous	5	5
Shale, brown, calcareous, with limestones 1" to 2" thick	20	25
Limestone, dark, hard	3	28
Shales and limestone; dark shale, alternating with thin limestone	5	33
Limestone, light-blue, shaly, impure, fossiliferous; **Orthotetes, Composita, Productus**	17	50

In passing northeastward across the county this limestone retains its general character and thickness and was noted along the Staunton and Parkersburg Pike, 0.6 mile southeast of the Pocahontas-Randolph County line, where the following section was measured. Here the base of the Reynolds Limestone comes only 45 feet above the top of the Greenbrier Limestone:

Local Measurement, Reynolds Limestone.

Greenbank District; elevation of top, 3400' B.

	Thickness. Feet.	Total. Feet.
Limestone, hackly, impure, weathering yellow, with profuse fossils, **Orthotetes, Spirifer**, crinoid stems, cup corals, bryozoa, gastropods	15	15
Shale, red	10	25
Limestone, red, siliceous, fossiliferous	10	35
Limestone, blue, weathering yellow	10	45

The above section shows a change in color of the middle portion of this member from a blue and gray limestone and shale, to a red limestone and shale.

The Reynolds Limestone at all its exposures in Pocahontas County is too shaly and impure for commercial purposes, except as a soil maker or possibly as a mixing agent in the manufacture of cement, to reduce the high lime content of some of the underlying limestone formations which are too pure when used alone.

BICKETT SHALE.

The **Bickett Shale**, named by Reger[28] from its occurrence

[28]Ibid., pp. 430-431.

PLATE XXIII.—View down Cranberry River from mouth of Tumbling Rock Run. Note Pottsville Conglomerate in background. (Photo. by Paul H. Price).

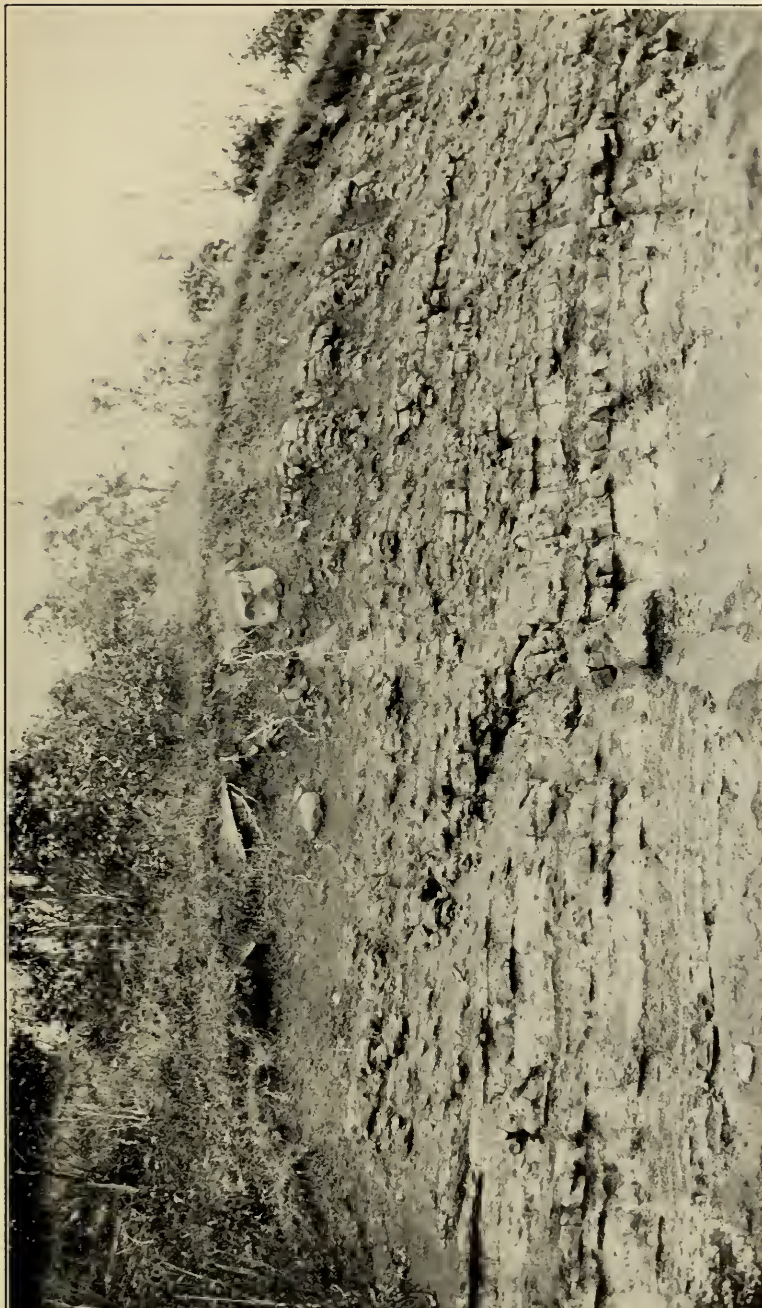

PLATE XXIV.—Upper portion of Reynolds Limestone of Mauch Chunk Series, along Seneca Trail (State route 24) 1¼ miles northwest of Edray. (Photo. by Paul H. Price).

PLATE XXV.—Lower portion of Reynolds Limestone of Mauch Chunk Series, along Seneca Trail (State route 24) 1¼ miles northwest of Edray. (Photo. by Paul H. Price).

PLATE XXVI.—View east across West Fork of Greenbrier River from the Staunton and Parkersburg Pike north of Durbin. Greenbrier Series in immediate foreground with Pocono sandstones forming the first range of mountains, while the upper Devonian Sandstones and Shales make up the succeeding ranges. (Photo. by Paul H. Price).

on Bickett Knob, Monroe County, is present in Pocahontas County and is noted in the Droop Mountain and Edray Sections. At its type locality it is a red and argillaceous but occasionally sandy deposit, coming between the Reynolds Limestone and the Webster Springs Sandstone (when present) or Glenray Limestone. The Bickett Shale, like the Webster Springs Sandstone, appears to be lenticular in character, and the two could very well be included under the same heading. The relationship is well illustrated in the following local measurements:

Bickett Shale horizon along new State road on Droop Mountain one mile northeast of Spice Post-Office:

	Feet.	
Limestone, Reynolds		
Shale, dark, calcareous	13	Bickett Shale
Shale, red	5	
Sandstone, Webster Springs, reddish-brown, shaly	10	
Shale, red	6	
Limestone, Glenray		

Bickett Shale horizon along new State road one mile north of Edray:

	Feet.
Limestone, Reynolds	
Shale, Bickett, red, green, sandy	50
Limestone, Glenray	

Bickett Shale horizon along Staunton and Parkersburg Pike 0.6 mile southeast of the Randolph-Pocahontas County line:

	Feet.
Sandstone, Webster Springs, reddish-brown	5
Shale, red (?)	10

An examination of these three respective horizons would therefore indicate that the interval between the Reynolds Limestone and the Glenray Limestone contains an assemblage of rocks which are sometimes entirely shale, and sometimes shaly with an included sandstone, the latter apparently correlating with the **Webster Springs**.

GLENRAY LIMESTONE.

The **Glenray Limestone**, so named by Reger[29] from its occurrence near Glenray, Summers County, and described as a gray and usually hard and somewhat sandy, but sometimes shaly deposit, varying in thickness from 80 to 125 feet, is present in Pocahontas County but is somewhat attenuated. In this area it is a series of hard, gray, thin limestones, alternating with gray, yellow and red shale with profuse marine fossils and it varies in thickness from 20 feet at the southern end of the county to 10 feet at the northern end. An examination of the three following sections shows its position and relationship in the series within the limits of this report:

Local measurement, **Glenray Limestone**, on Droop Mountain 0.6 mile northeast of Spice Post-Office:

	Feet.
Limestone, Reynolds	50
Sandstone, Webster Springs	10
Shale	6
Limestone, Glenray, gray, fossiliferous, shaly at top and bottom	20
Shale, Lillydale	20
Greenbrier Limestone	105

Local measurement, **Glenray Limestone**, one mile northwest of Edray:

			Ft.	In.
Limestone, Reynolds			30	0
Shale, Bickett			50	0
Limestone, hard, impure, siliceous, fossiliferous	5′ 0″	Glenray Limestone	14	6
Shale, red, and yellow, with thin limestone, (Lot 18)	8 0			
Limestone, siliceous, fossiliferous	1 6			
Shale, Lillydale			58	0
Greenbrier Limestone Series				

Local measurement, **Glenray Limestone**, along Staunton and Parkersburg Pike, 0.7 mile southeast of Randolph-Pocahontas County line:

	Feet.
Limestone, Reynolds	45
Sandstone, Webster Springs	5
Shale, red	10

[29]Ibid., pp. 432-437.

	Feet.
Limestone, Glenray, red and shaly	10
Concealed	20
Greenbrier Limestone Series	

A study of these three sections would raise the question as to whether the Glenray Limestone or the Reynolds Limestone is the persistent member that extends farthest north. Accepting the correlations from their type localities as correct, the increased thickness of the Reynolds Limestone and the decrease in thickness of the Glenray Limestone would seem to indicate that it is the former member.

The Glenray Limestone is too impure to be of any commercial value, but has been used locally for road surfacing and found very satisfactory.

LILLYDALE SHALE.

The **Lillydale Shale** of Reger[30], named from its occurrence in the vicinity of Lillydale, Monroe County, and being a heavy bed of fissile material, dark-green or greenish-gray at top, but black and carbonaceous at base, with many included lenses of iron carbonate or limestone and with occasional sandstone, the thickness varying from 80 to 125 feet, is also present in Pocahontas County. In the General Section appearing at the beginning of this chapter it is described as greenish-gray to dark shale at top, black, carbonaceous and fissile at base, with occasional thin limestones. It contains marine fossils, and varies in thickness from 30 to 50 feet. Its position is immediately below the Glenray Limestone and just over the Edray Sandstone, except when the latter is absent, and at such points it rests directly upon the Alderson Limestone of the Greenbrier Series, making it the basal member of the Bluefield Group. Its character and thickness were noted at various points in Pocahontas County and it is recorded in the Briery Knob, Droop Mountain, Edray, Stamping Creek, and Durbin Sections.

EDRAY SANDSTONE.

The **Edray Sandstone** was named by Reger[31] from its occurrence on the old road 1.2 miles north of Edray, where

[30]Ibid., pp. 438-443.
[31]Ibid., pp. 443-444.

it is a 25-foot, green, shaly or flaggy sandstone. This sandstone like many others of the Mauch Chunk Series is lenticular in character and does not appear in the Edray Section which was measured along the new State road from Edray to the head of Elk, but at other points it presents a prominent exposure. It occurs associated with the Lillydale Shale, at times coming well up in this member, and at some points near the base, but often resting directly on the Alderson Limestone of the Greenbrier Series. Its best development is along the waters of Elk, forming a massive cliff rock at the junction of Big Spring Fork with Old Field Fork of Elk River, and it is recorded in the Slaty Fork and Props Run Sections. In the southern end of the county it is noted in the Stamping Creek and Briery Knob Sections, as a brown to gray, fine-grained, micaceous sandstone, varying in thickness from 10 to 25 feet.

ECONOMIC ASPECTS, MAUCH CHUNK SERIES.

From an economic standpoint the Mauch Chunk Series does not have much to offer which can be readily exploited. The coals are all too thin and impure for even local domestic use. So far as known it contains no precious ore or metals. The shales could be used for the manufacture of brick and tile, but owing to an almost universal occurrence of this material, the demand would be limited to local use. The limestone of this series is of little value except as a soil maker as compared to the underlying Greenbrier Series. The soil from this series seems best adapted for timber growth and grazing land.

One sandstone, the Droop, offers a good prospect, at its type locality on Droop Mountain, as a glass-sand. Samples collected show it to be a remarkably pure sand, and by washing with dilute muriatic acid a practically pure product can be obtained.

CHAPTER VIII.

STRATIGRAPHY—GREENBRIER SERIES.

GENERAL ACCOUNT AND SECTION, GREENBRIER SERIES.

The Greenbrier Series, comprising the middle portion of the Mississippian and coming directly under the Mauch Chunk Series and immediately over the Maccrady Series, is composed almost entirely of limestone rocks. The name was derived, apparently, from the Greenbrier River, along which its best and greatest exposures occur, but by whom the title was first applied is not apparent. It is possible the name "Maxville" of Andrews[1] is entitled to priority, but like many other instances, the title of Greenbrier has become so well fixed in the literature of this and adjoining States that it seems unwise to supplant it by the Ohio title, and furthermore this formation in the latter State represents only a small portion of the Series at its type locality in West Virginia, and no definite correlation between the two has been made.

The base of this series has in West Virginia been quite definitely established as resting upon the Maccrady red and purple shales and yellow earthy limestone in the more southern counties; and on the Pocono Sandstones, which offer a still greater contrast, in northern West Virginia, where the former shaly beds have disappeared.

The Greenbrier Series in the area under discussion has a thickness that varies from approximately 300 to 600 feet, with a rapid thinning to the northeastward. Its maximum thickness here offers a contrast to its much greater thickness

[1]E. B. Andrews, Ohio Geol. Sur., Report Progress, 1869, pp. 80, 84; 1870.

in southern West Virginia where Reger[2] has been able to trace many of the minor subdivisions over considerable areas and has given them suitable titles. These subdivisions while somewhat attenuated have been recognized in Pocahontas County and will be, so far as applicable, retained in this report. A portion of the Greenbrier Series has attained a character that classifies it as a grade of marble and will be discussed in detail under a separate heading.

The following general section was prepared from several measured sections and local notes and indicates the character of the series in the area of this report:

General Section of the Greenbrier Series for Pocahontas County, West Virginia.

	Thickness. Feet.	Total. Feet.
Limestone, Alderson, dark-gray, sandy, with crystalline streaks; very hard, occasionally oolitic, with numerous fossils, bryozoa (**Archimedes**), brachiopods, crinoids, (especially **Pterotocrinus**), corals, and a few pelecypods (**See Lots 7, 8, 8A, 19, 24,** and **55**)................................	50 to 75	75
Shale, Greenville, brown to dark, fissile, calcareous, lenticular, with marine fossils; abundant **Chonetes,** fish tooth (**See Lots 8 and 8A**); probable horizon of **Cypress Sandstone** of Illinois which is absent in southern West Virginia, but recurs in northern end; See Durbin Section..................	20 to 40	115
Limestone, Union, gray to dark, weathering white, hard, shaly at top; in vicinity of Hillsboro, pink, gray, and red, oolitic (See Marble); contains profuse marine fossils; **Pentremites, Archimedes,** gastropods, bryozoa. In northern end of county a sandstone intervenes between the upper and lower portions which is probably the **Bethel**.........	75 to 100	215
Limestone, Pickaway, dark, hard, brittle, with occasional red streaks, but with only sparing marine fossils.........................	50 to 175	390
Limestone, Taggard, gray, oolitic, fossiliferous, associated with red shale..................	10 to 25	415
Limestone, Patton, somewhat shaly at top, but hard, pure, and weathering gray at base; usually contains 5 to 10 feet of light-gray oolite; marine fossils; occasional nodules of black chert..........................	10 to 150	565

[2]David B. Reger, Mercer, Monroe, and Summers Report, W. Va. Geol. Sur., pp. 449-451; 1926.

	Thickness. Feet.	Total. Feet.
Shale, Patton, gray and calcareous, occasionally red	0 to 15	580
Limestone, Sinks Grove, blue, hard, siliceous, weathering yellow at top and gray at base; often contains nodules of black chert; also contains marine fossils, brachiopods, bryozoa, crinoids, and gastropods	0 to 50	630
Limestone, Hillsdale (St. Louis age as correlated in Kentucky), grayish-blue, hard, massive; profuse marine fossils including **Lithostrotion canadense, (L. basaltiforme), L. proliferum;** basal 15 feet contains nodules of gray and black chert	0 to 80	710
Maccrady Series		

SUBDIVISIONS, GREENBRIER SERIES.

In the above general section, Reger's[3] classification for southern West Virginia, which was the first of its kind for this series in any of the West Virginia Reports, has been followed. The subdivisions have been based on both lithologic and paleontologic characteristics. While these subdivisions were made approximately 100 miles to the southwest their same general character and faunal relationship extend as far north as Pocahontas County.

TOPOGRAPHIC EXPRESSION, GREENBRIER SERIES.

In Pocahontas County the Greenbrier Series, with one exception, is limited to that portion west of the Greenbrier River. In the northern end of the county in the region of Blister Swamp, however, there is a small amount of Greenbrier forming the southern end of a larger area known locally as The Sinks, the greater part of which is in Randolph County. The longest single exposure of this series lies directly west of the Greenbrier River and roughly parallels it the entire length of the county, forming a continuous outcrop for more than 55 miles. The topography as expressed by this exposure is unlike at opposite ends of the county. In the northern half the readily soluble limestone series forms a steep bench at the top of the more resistant Pocono Sand-

[3]Ibid., pp. 449-451.

stones. In the southern half of the county, and particularly in the vicinity of Hillsboro, there is a broad expanse of county covered by this series and known locally as Little Levels. Here the ground is mainly a plateau, below which the Greenbrier River has cut down through a few hundred feet of strata and many of the small streams have cut underground channels which form numerous sink-holes at the surface. In the vicinity of Lobelia and Jacox these streams, particularly Hills Creek, Bruffey Creek, and Rush Run, have sought underground passageways to Greenbrier River beneath Droop Mountain. In certain sections around Hillsboro the more resistant limestone beds occur as reefs and form low ridges, and along the western part of the region the sandstones of the lower part of the Mauch Chunk Series form table-lands or mountains not yet eroded down to the Harrisburg Peneplain level which forms the surface of the plateau around Hillsboro. In the area of northwestern Edray District the drainage of Elk River has in just recent geologic time cut into this series and offers no distinct topography, except that the streams often sink beneath the channel beds to emerge again some distance farther down.

AREAL EXTENT, GREENBRIER SERIES.

In Figure 7 the areal extent of the Greenbrier Series can be seen at a glance, while Map II shows the same outcrops in much greater detail. By this figure and map the relative amount of the surface of this county that is covered by the Greenbrier Series can be seen.

The full series of this county can be studied to the best advantage along the new State road just northwest of Edray. Here the fresh cuts have exposed its entire thickness in beds which are approximately horizontal, and which afford the best opportunity for detailed study.

CONTACTS, GREENBRIER SERIES.

The contact of the Greenbrier Series with that of the overlying Mauch Chunk has been discussed under the description of the latter Series, in Chapter VII, page 143.

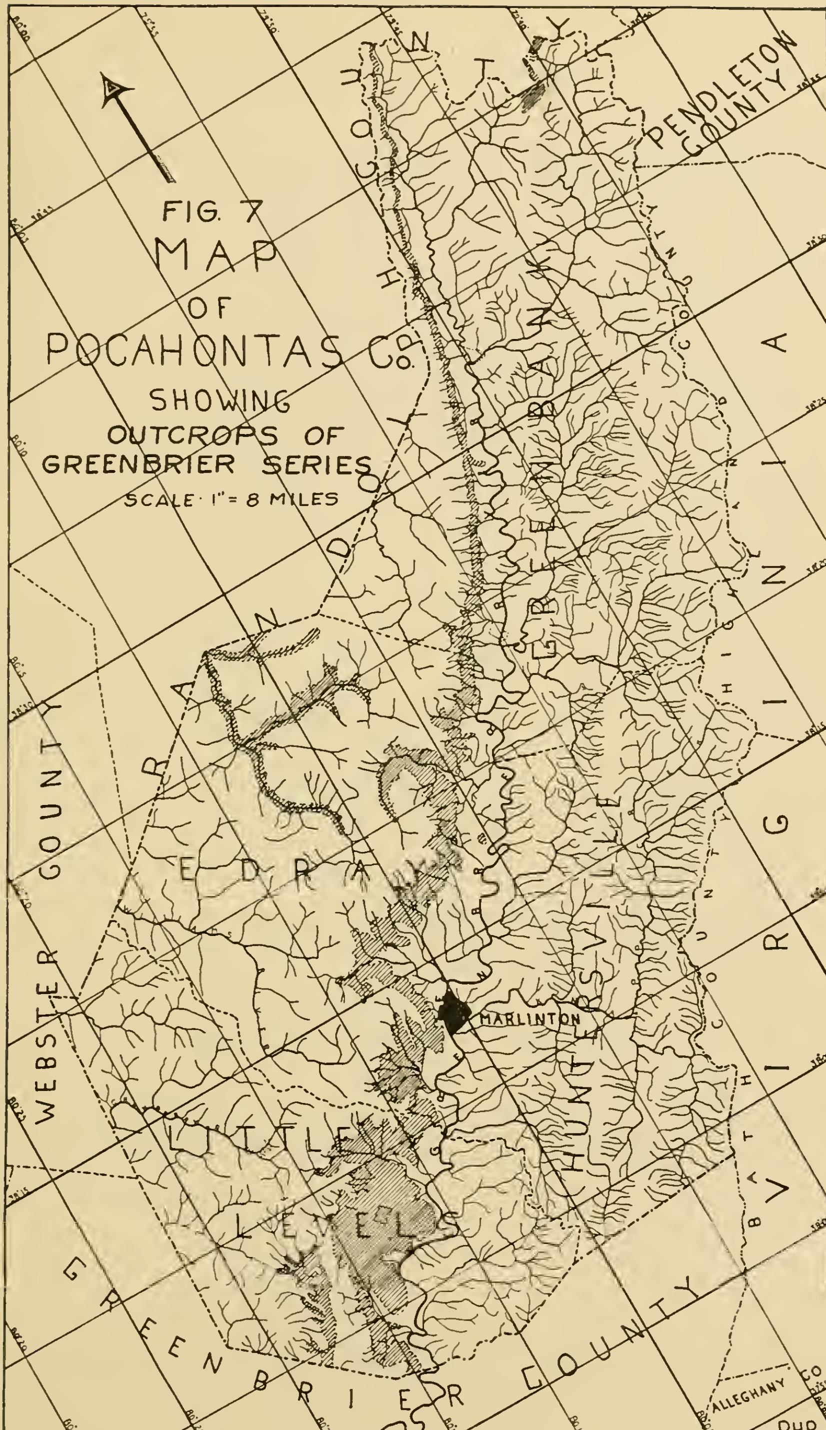
FIG. 7
MAP
OF
POCAHONTAS Co.
SHOWING
OUTCROPS OF
GREENBRIER SERIES
SCALE 1" = 8 MILES
RANDOLPH COUNTY
PENDLETON COUNTY
HIGHLAND COUNTY
VIRGINIA
WEBSTER COUNTY
GREENBRIER COUNTY
BATH COUNTY
ALLEGHANY CO
EDRAY
LITTLE LEVELS
HUNTERSVILLE
GREENBANK
MARLINTON
PHP

At the base of the Greenbrier the contact is much more marked with the Hillsdale member resting upon the Maccrady Series, when present, and when the latter series is absent, resting upon the Pocono Series. In the Maccrady the strata are composed of red or maroon shales, or weakly bedded sandstones, largely devoid of fossils, with only an occasional yellow and earthy, fossiliferous limestone at the top. At one point in particular where this limestone phase was better developed than others the red shales are absent, being replaced by a calcareous shale which may be of Warsaw age. In the McLaughlin Springs Section the cherty Hillsdale member, of St. Louis age, rests upon a light-gray to blue, calcareous shale containing numerous small geodes. The weathering of this outcrop releases large numbers of specimens which are now to be found in the stream beds.

In Pocahontas County a large portion of the Maccrady Series is absent, as compared to its type locality near Maccrady and Saltville, Virgina. Dr. Girty[4] who has collected and studied fossils from this series, in the area under discussion, surmises that the Maccrady may be of Warsaw age, although he states the evidence is quite unsubstantial. If this assumption should prove to be true, and the overlying Hillsdale Limestone, that forms the basal member of the Greenbrier Series in southern West Virginia, proves to be of St. Louis age, as contended by Butts and Reger, then the unconformity between the Greenbrier and Maccrady is represented by the absence of the Spergen Limestone of Indiana.

FOSSIL LIFE, GREENBRIER SERIES.

Within the limits of Pocahontas County the Greenbrier Series was found to be fossiliferous throughout, with the possible exception of an occasional shale. Several collections were made in the field by the writer, and these have been studied by Dr. Tilton, whose identifications along with a brief comment appear in Chapter XV under the heading Notes on Paleontology. (See **Lots 6, 7, 8, 8A, 19, 24,** and **55**).

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[4]George H. Girty, Observations on the Faunas of the Greenbrier Limestone and Adjacent Rocks, Tucker County Report, W. Va. Geol. Sur., pp. 482-483; 1923.

During the fall of 1920 Dr. George H. Girty and Dr. Wm. Armstrong Price made a few collections from this series near Mill Point, the identifications of which, along with some discussion by Dr. Girty, were published in the Tucker County Report,[5] and in view of their pertinence his identifications and comments are herein republished:

"The Greenbrier proved to be sparingly fossiliferous in this region. A coral here and there (probably belonging to the genus Triplophyllum) was all that a careful search disclosed, except near the top where fossils became more plentiful. About 50 feet below the top of the Greenbrier the following fauna was collected (Lot 3284):

Cystelasma ? sp.
Pentremites aff. Okawensis
Fistulipora excellens var. Harrisonensis ?
Fenestella tenax
Polypora ? aff. corticosa
Polypora ? sp.
Lingulidiscina sp.
Crania Chesterensis ?
Orthotetes Kaskaskiensis var.
Productus ovatus
Dielasma Arkansanum
Camarophoria explanata
Spirifer Leidyi ?
Spiriferina spinosa ?
Spiriferina transversa
Composita subquadrata ?
Cliothyridina sublamellosa
Eumetria Verneuiliana
Nucula Illinoisensis ?
Conocardium Chesterense ?
Leptodesma Spergenense ?
Pleurotomaria sp.
Pleurotomaria aff. Bonharborensis
Naticopsis (Naticella ?) n. sp.
Bulimorpha aff. bulimiformis
Sphaerodoma ? sp.
Orthoceras aff. epigrus.

"The single Pentremite listed above is apparently a young specimen and the identification suggested may be remote from its true relations.

"About 25 feet lower in the section, or 75 feet below the top of the Greenbrier, we collected the following (Lot 3285):

Triplophyllum sp.
Pentremites Godoni
Stenopora aff. Cestriensis
Fenestella serratula
Fenestella multispinosa ?
Chonetes sericeus ?
Productus ovatus

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[5]Ibid., pp. 453-7.

Pustula aff. Indianensis
Diaphragmus elegans
Camarophoria explanata
Dielasma Arkansanum
Spirifer sp.
Spiriferina subspinosa
Reticularia setigera
Composita subquadrata
Cliothyridina sublamellosa
Eumetria Verneuiliana
Cypricardella ? aff. oblonga
Euomphalus planidorsatus
Naticopsis (Naticella ?) n. sp.

"I am here following Professor Weller's interpretation of **Pentremites Godoni** as a specimen having flat, instead of strongly concave, ambulacral areas. The collection contains 3 specimens of which one is evidently immature and consequently may be left out of consideration. The better of the two mature specimens is not typical in that it is uncommonly short and broad, having the sides much contracted towards the apex, so that the outline in side view is conspicuously triangular. The other specimen appears to have a more normal configuration, but some of its characters are not well shown.

"As our Greenbrier faunas come from near the top of the formation (except those considered later on) and as our Mauch Chunk faunas come near the base of the rocks assigned to that formation, all occur within rather narrow stratigraphic limits, and do not in fact show very striking differences. The differences which might be expected between the faunas of a formation preeminently calcareous and a formation preeminently shaly and which do in fact exist in a broad way between the Greenbrier and the Mauch Chunk (or the contemporaneous Pennington) are by no means striking. I refer of course to the tendency of the brachiopod element to prevail in faunas obtained from limestone formations and of true mollusks (especially pelecypods and gastropods) to prevail in faunas obtained from shale formations. As listed above the Mauch Chunk faunas contain as many brachiopods, in species, as the Greenbrier faunas, and the Greenbrier faunas nearly as many mollusks as the Mauch Chunk faunas. There is, it is true, not a little difference between the mollusks of the one formation and those of the other, but whether this difference is persistent and distinctive or is due merely to incomplete collections from a richly varied mulluscan fauna, the present evidence is too limited to show. I suspect that there exists a real difference in the molluscan representation, but not of the degree nor yet of the character that these lists suggest.

"The brachiopod representation of the two faunas is, of course, very nearly the same. Certain differences are obvious, some of which appear to be significant, while others probably are not. The presence of **Camarophoria explanata** in both Greenbrier collections and its absence from all three Mauch Chunk collections would appear to be noteworthy and also the abundance of **Martinia** in one of the Mauch Chunk collections and its absence from the Greenbrier collections.

"As has already been remarked, the main body of Greenbrier is surprisingly poor in fossil remains—at least in this region. Except for the two collections obtained within 75 feet of the top the only other fossils collected came from within 70 feet of the base of the formation, leaving between the fossiliferous upper part and the fossiliferous lower part an interval of about 800 feet unrepresented in our collections. At one locality in the lower part of the Greenbrier (within 70 feet of the base so far as we could determine, though at the locality we could determine only that the horizon was not far above the base) we collected the following species (Lot 3282a):

Anisotrypa n. sp. aff. solida
Chonetes sericeus
Orthotetes Kaskaskiensis var.
Avonia Arkansana var. multilirata ?
Productus inflatus
Productus ovatus
Diaphragmus elegans
Camarotoechia Purduei ?
Spirifer Leidyi ?
Composita subquadrata
Cliothyridina sublamellosa.

"This collection represents a single locality and horizon; the following represents a single locality but several horizons, ranging perhaps through 70 feet of the basal part of the Greenbrier, the lower limit of which is here closely determinable (Lot 3283):

Lithostrotion basaltiforme
Fenestella tenax
Polypora aff. nodicarinata
Dichotrypa expatiata ?
Rhombopora sp.
Orthotetes Kaskaskiensis
Productus ovatus
Productus inflatus var.
Productus parvus ?
Pustula biseriata ?
Camarotoechia Purduei ?
Spirifer Leidyi
Composita subquadrata
Cliothyridina sublamellosa.

"The following collection was made at a number of points all within a square mile of territory and at a number of horizons all in the lower part of the Greenbrier and mostly within 50 feet of its base (Lot 3282:)

Virgula ? n. sp.
Endothyra n. sp.
Lithostrotion basaltiforme
Triplophyllum Pellense
Campophyllum n. sp.
Monilipora n. sp.
Stenopora sp.
Productus inflatus
Productus sp.
Bellerophon scissile.

"All three of the collections from the basal part of the Greenbrier have much in common and much, moreover, that is unusual, though they show individual characters which can readily be seen by comparing the lists with one another.

"These faunas are in marked contrast to the faunas of the upper part of the Greenbrier, and not only so, but they indicate a different geologic age, for while the upper faunas are obviously Chester, these lower ones are doubtfully so. It seems opportune for me to say that in the following discussion the Ste. Genevieve Limestone is not regarded as forming part of the Chester group and the term Chester is employed in a sense that excludes the Ste. Genevieve.

"These three faunas differ from one another more or less, and they differ greatly from the higher faunas in the Greenbrier; how greatly can readily be seen by comparison of the faunal lists. In their relation to one another Lots 3282 and 3283 stand together, while Lot 3282a has little that is really significant in common with the two others. The mode of preservation also is different, the specimens forming Lot 3282a being inclosed in a calcareous matrix but those of the two other collections being silicified and occurring free. It is possible, therefore, that Lot 3282a represents a higher horizon and is of a younger geologic age, although we did not think so when the collection was made.

"The sponge cited as **Virgula** (?) n. sp. (found only in Lot 3282) is abundant, and its organic nature might easily be overlooked. It occurs as subcylindrical stems rarely more than one inch in diameter and broken into segments, few of which are as long as 3 inches. Some of the pieces are curved, but none shows any evidence of branching. At first glance they appear to be merely ropy pieces of chert, but many of them, if examined with a glass, show spicular structure very clearly.

"Large compound corals of the type commonly identified as **Lithostrotion basaltiforme** are also common (represented in Lots 3282 and 3283, but not in 3282a). It has been the practice to refer all the massive **Lithostrotions** or those which have polygonal corallites in contact with one another, to a single species (**L. basaltiforme**), and all the bushy forms that have cylindrical corallites separated from one another, to another species (**L. proliferum**). It is in this loose way that the name **L. basaltiforme** is used in this place. The mode of growth is, of course, an important character in these corals, but it can not be safely used without regard to their internal structures and it is probable that each of the 'species' when carefully studied will be found to constitute not a single species but a group.

"Attention may also be called to **Campophyllum** n. sp., **Chonetes sericeus** and **Camarotoechia Purduei**, type that are more or less alien to the upper Mississippian faunas of the typical sections. **Diaphragmus elegans** can be definitely identified in one of the collections (3282a). **Productus inflatus**, which has a certain stratigraphic significance, is fairly abundant at the same locality as the foregoing, and the identification is fairly close, though some characters are not well enough shown for comparison with typical specimens."

CORRELATION, GREENBRIER SERIES.

In view of the present available information along with conflicting opinions as to the relative ages of different groups, a proper and satisfactory correlation of the Greenbrier Series, the basal members of the Mauch Chunk Series, and the Maccrady Series, with their equivalents in other areas, will not be obtained until each is studied in its entirety. A summing up of the probable correlation of the Greenbrier Series, as present in Pocahontas County, with its equivalents in other States is as follows:

The Alderson Limestone, Greenville Shale, and the upper portion of the Union Limestone appear to be a part of the Chester Series of Illinois. In the middle portion of the Greenbrier Series, those beds from the Pickaway Limestone down to the base of the Sinks Grove Limestone, totaling approximately 440 feet of strata, and appearing to be confined to middle and southern West Virginia and southwestern Virginia, may possibly fill the gap postulated by Butts[6] as occurring between the Ste. Genevieve and St. Louis Limestones.

The separation of the Gasper and Fredonia portions of the Union Limestone is mainly a paleontologic problem in the greater part of this area. There is, however, a red, calcareous sandstone between the upper and lower portions of this limestone in the northern end of the county which Reger tentatively classified as the Rosiclare in his Mercer Report but which he now considers as more probably the Bethel Sandstone as will shortly appear in his Randolph Report. Its position is illustrated in the Durbin Section, page 117. If this correlation can be substantiated by a further faunal relationship the separation of the Gasper and Fredonia members should be less difficult in adjoining areas.

The Hillsdale Limestone or basal member of the Greenbrier Series in Pocahontas County is correlated as of St. Louis age as described by Butts[7] in eastern Kentucky. It is a blue, hard, massive limestone, with the lower portion containing nodules of gray and black chert, with a large assemblage of marine fossils, the most common, conspicuous and important being two species of a coral, **Lithostrotion**, especially **L. canadense**. These occur in compact colonies, or occasionally single corallites, in layers, in which they become silicified, and from which they weather out, and scatter over the surface of the underlying Maccrady Series. These silici-

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[6]Chas. Butts, Mississippian Series of Eastern Kentucky, Ky. Geol. Sur., pp. 129-136; 1922.
[7]Ibid., pp. 120-136.

fied heads or masses vary in size from a few inches to a foot or more in diameter, forming curious objects locally known as "honey-comb" rocks. These odd and beautifully shaped objects are now found throughout the limits of this exposure, often piled in ricks and used as curiosities around the homes.

DESCRIPTION OF MEMBERS, GREENBRIER SERIES.

ALDERSON LIMESTONE.

The **Alderson Limestone** was named by Reger[8] from its occurrence in the vicinity of Alderson, Monroe County, where it is described as a dark-gray calcareous formation, weathering almost to a dirty yellow color, with a thickness which varies from 75 to 325 feet, and having an abundance of marine fossils. Attention is called to the variation in bedding at its type locality, there being some zones which are highly siliceous and which make a hard and durable limestone, and others which are fairly pure and crystalline, while still others are shaly and readily disintegrate. In Pocahontas County, somewhat the same character is retained except in a less degree. This member represents the succession of beds coming between the dark Lillydale Shale of the Mauch Chunk Series and the underlying Greenville Shale. In the general section at the beginning of this chapter it is shown as being dark-gray and sandy, with crystalline streaks, very hard, and containing numerous marine fossils, the most conspicuous of which are **Pentremites** which weather out in great abundance and which are locally called "petrified hickory nuts". The character and thickness of this member at various points in the county are recorded in the Droop Mountain, Edray, and Durbin Sections.

GREENVILLE SHALE.

The **Greenville Shale**, named by Reger[9] from its occurrence near Greenville, Monroe County, where it is a black, fissile, and carbonaceous deposit, belonging, when present, between the Alderson and Union Limestones, being quite len-

[8]David B. Reger, Mercer, Monroe, Summers Report, W. Va. Geol. Sur., pp. 462-466; 1926.
[9]Ibid., pp. 466-7.

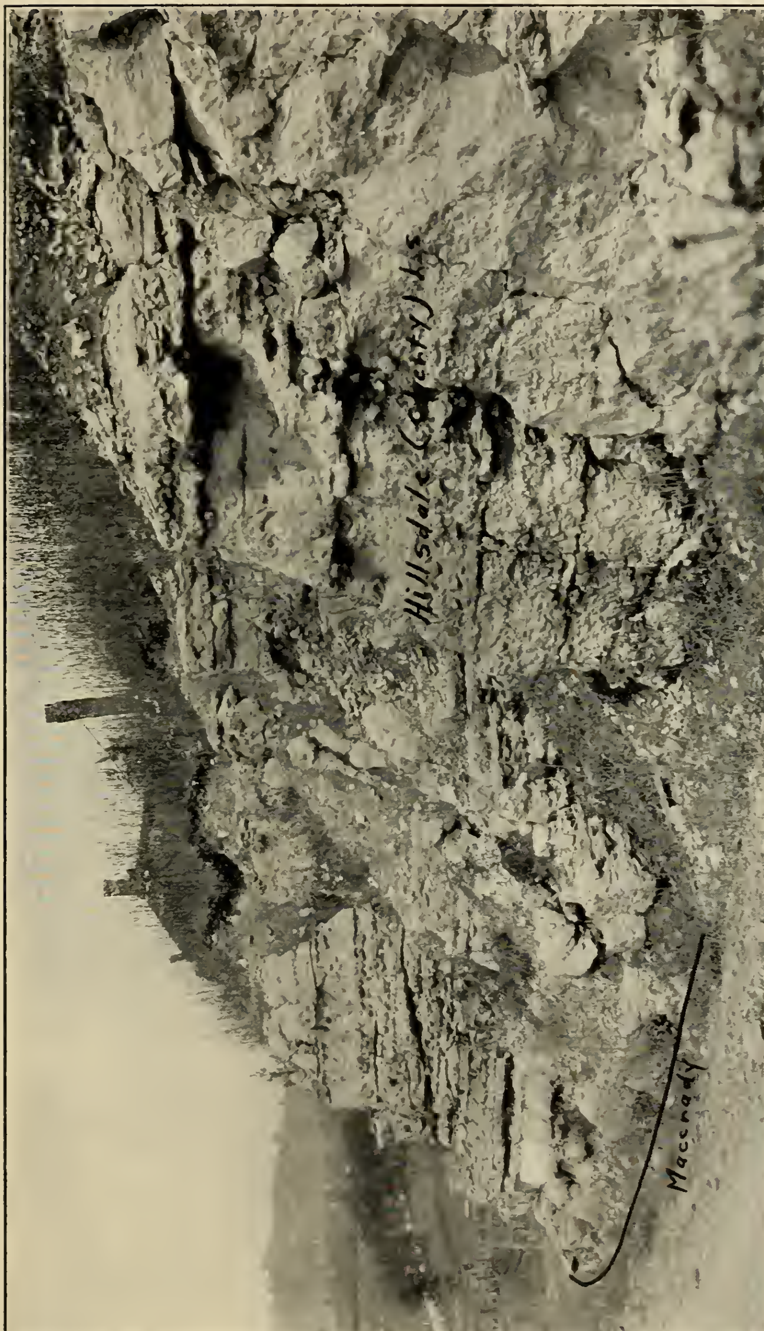

PLATE XXVII.—Hillsdale (basal member of Greenbrier) Limestone. Note nodules of chert standing in relief. One-half mile northeast of Mill Point. (Photo. by Paul H. Price).

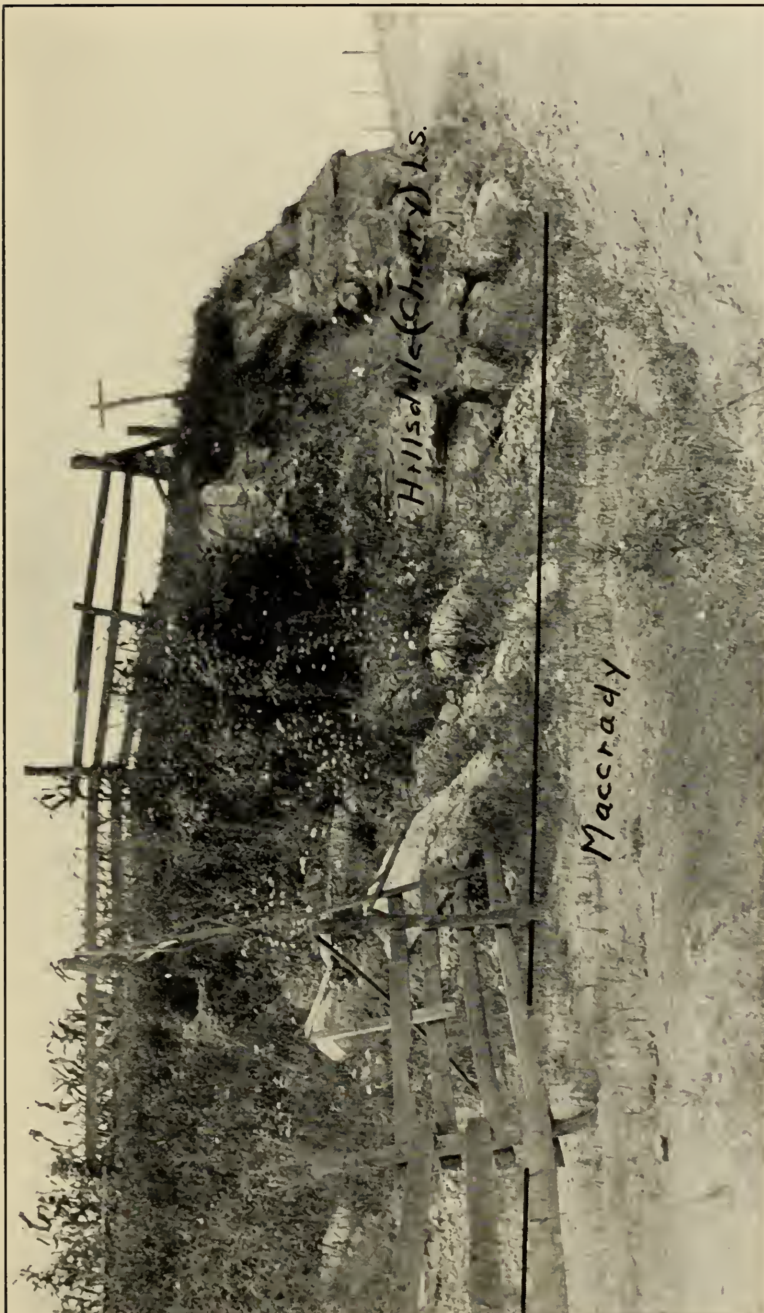

PLATE XXVIII.—Maccrady-Greenbrier contact. Cherty Hillsdale member of Greenbrier Limestone resting on red shales of Maccrady Series. One-half mile northeast of Mill Point. (Photo. by Paul H. Price).

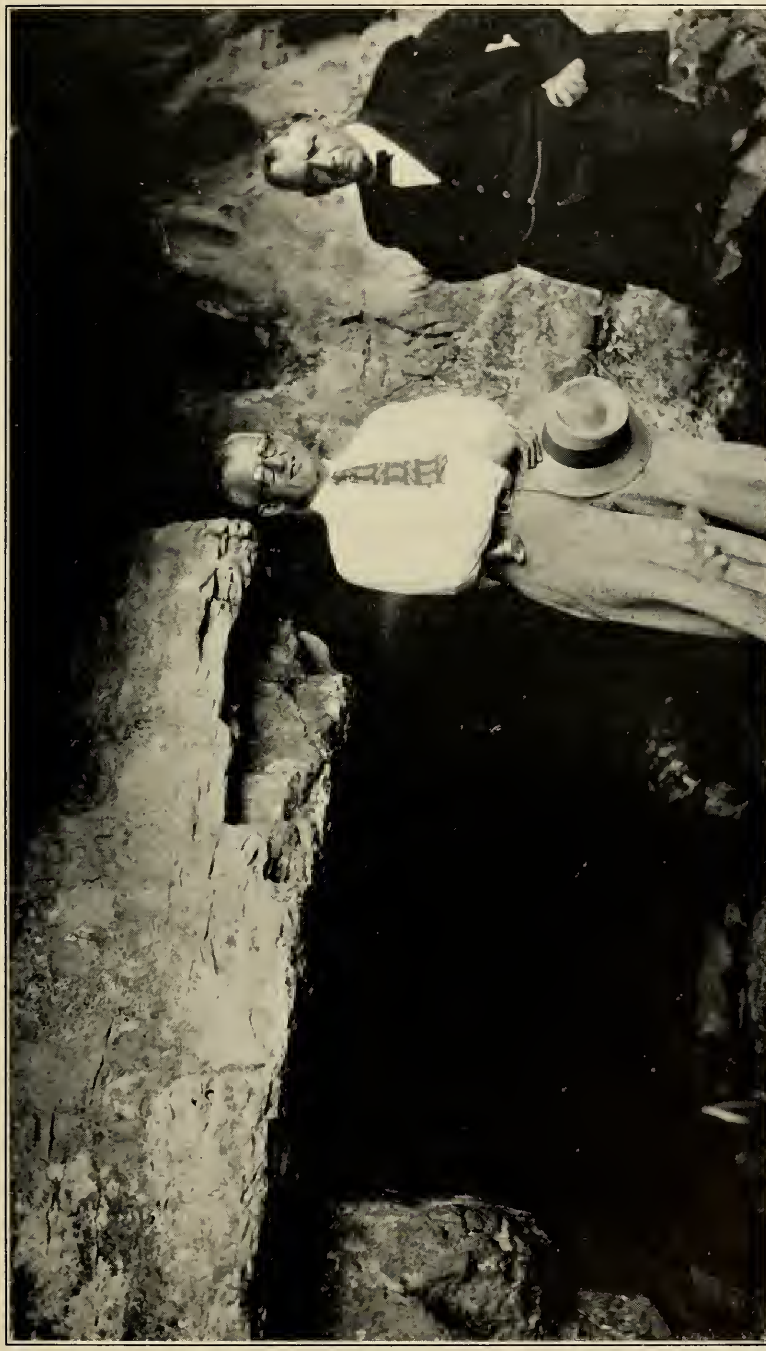

PLATE XXIX.—Cave near base of Greenbrier Limestone at head of Stevens Hole Run. This cave was the home of Steven Sewell for several years and is now a point of interest for tourists. (Photo. by Paul H. Price).

PLATE XXX.—Berea Conglomerate at base of Pocono Series along State route 43, one-half mile southeast of Marlinton. (Photo. by Paul H. Price).

ticular and containing marine fossils and attaining a thickness of 100 feet, at certain localities, is present in Pocahontas County. This shale appears to be confined to the southern half of the county where it is brown to dark, fissile, and calcareous, containing numerous marine fossils, and an occasional shark tooth. (See **Lot 8A**). This shale was noted to good advantage in the vicinity of Lobelia and also on Droop Mountain. It was also observed along the new State road one mile northwest of Edray, where it is dark-brown, calcareous, crumbly, and contains marine fossils, particularly **Chonetes**.

In the northern end of the county this interval is occupied by a 20-foot, red, shaly sandstone which may correlate with the **Cypress** of Illinois.

UNION LIMESTONE.

The **Union Limestone**, belonging just under the Greenville Shale, is probably the most important and persistent member of the Greenbrier Series in Pocahontas County. It was named by Reger[10] from its occurrence at Union, Monroe County, where it is a gray, hard limestone weathering white, and being often crystalline, usually pure, frequently having an oolitic structure and containing numerous marine fossils, its thickness varying from 100 to 275 feet. In Pocahontas County the same general character is retained, its nature being that of a gray to dark, hard limestone, which weathers white, is shaly at the top, and usually oolitic. Marine fossils are scattered throughout but so retained in the matrix that collections are not readily made.

In the vicinity of Hillsboro the Union Member has attained a character that classifies it, to the trade, as a grade of **Marble**. Here it is very fossiliferous, containing such marine life as blastoids **(Pentremites)**, crinoids, brachiopods, corals, gastropods, and bryozoa **(Archimedes)**. Along with this abundance of marine life are millions of minute concretions resembling fish roe which are called oolite. Either at the time of deposition or by later infiltration from circulating waters (probably the former), sufficient coloring was carried

[10] Ibid., pp. 467-472.

in to give it a pleasing appearance to the eye and more especially when given a polish. These deposits vary in color from red or maroon to a pinkish tinge and from that to various shades of gray. This marble phase varies from 25 to 40 feet in thickness with the red or maroon at the top which is highly fossiliferous and oolitic, and blends into a light fossiliferous oolite, with the various shades of gray at the base. This particular development of the Union Limestone was found only in Little Levels District.

In the northern end of the county a 10-foot, red, shaly, and calcareous sandstone occurs between the upper and lower portions of the Union member which possibly correlates with the **Bethel** and which marks the division between the limestone of Gasper age and that of Fredonia age.

PICKAWAY LIMESTONE.

The **Pickaway Limestone**, named by Reger[11] from its occurrence in Monroe County, near Pickaway, and described as a very dark, hard and sandy deposit immediately below the Union Limestone, varying in thickness from 175 to 400 feet, is present in Pocahontas County. Throughout most of Monroe County its structure is almost entirely stylolitic. In the area of this report this same limestone is generally a dark, hard, brittle formation which is sparingly fossiliferous and which varies in thickness from 50 to 175 feet, the stylolitic structure of its type locality being entirely absent. This member forms the upper portion of the succession of rocks in Virginia and southern West Virginia, which occupies the interval between strata of Chester and St. Louis age, without apparent equivalent outside these two States. This member disappears in northern Pocahontas County but according to Reger[12] it increases to 700 feet in Washington County, Virginia, and then declines rapidly in thickness and wholly disappears before reaching the boundaries of Kentucky and Tennessee.

From an economic standpoint the Pickaway Limestone is generally too impure to be used where a high-grade lime-

[11]Ibid., pp. 473-476.
[12]Ibid., pp. 473-474.

stone is required, being high in both silica and magnesium carbonate. Because of its hard, durable character it makes excellent road material.

TAGGARD LIMESTONE.

The **Taggard Limestone**, named by Reger[13] from its occurrence on Taggard Branch, Monroe County, is present in Pocahontas and retains the same general oolitic character as noted at its type locality, except that it was not considered advisable to separate it from its associated shales. Along the new State road cut one-fourth mile west of Edray the following section was measured:

Shale, red, with thin streaks of oolitic limestone	8′	Taggard Limestone (24′)
Limestone, gray, oolitic	4	
Shale, red	1	
Limestone, impure, cobbly	3	
Limestone, gray, impure, streaked with red	8	

This limestone was noted also in the Droop Mountain Section, and outcrops along the Seneca Trail (State Route 24), three miles southwest of Hillsboro at a point where the road to Locust leaves the main highway. Here it is described as a gray, oolitic limestone, fossiliferous, and streaked with red shale and having a thickness of 25 feet.

From an economic standpoint the Taggard Limestone is of minor importance, being too thin, impure, and shaly for commercial use. As a correlation plane it forms an excellent key rock of much value in the study of the Greenbrier Series.

PATTON LIMESTONE.

The **Patton Limestone**, named by Reger[14] from its occurrence near Patton, Monroe County, where it is a heavy and usually massive bed, somewhat shaly and sandy at the top, but in the middle and lower portions hard, blue, and weathering to a gray color, with occasional nodules of black chert, but being generally freer from impurities than most of the other members of the series, is present in Pocahontas

[13]Ibid., pp. 476-479.
[14]Ibid., pp. 480-483.

County. In the region of its type locality in southern West Virginia it varies in thickness from 100 to 250 feet and usually contains scattered marine fossils. This member of the Greenbrier Series is also present in Pocahontas County and was generally noted. Its best development is in the southwestern portion but it thins rapidly to the northeast. In this area it is a dark, hard, massive bed in the middle and lower portions, being somewhat shaly at the top, containing marine fossils, and occasionally nodules of black chert. Its greatest thickness is noted in the Droop Mountain Section where it is approximately 200 feet thick, its exposure being on the eastern side of the mountain one-half mile north of Locust Creek School. Along its northern extension it decreases rapidly in thickness until a point is reached along the Staunton and Parkersburg Pike two miles northwest of Durbin where it is only a 10-foot, greenish-gray, earthy limestone.

From an economic standpoint the Patton Limestone ranks second in importance only to the Union Limestone, there being many exposures, in the southern half of the county, of comparatively pure limestone that could be used for purposes where good material is desired, including both agricultural lime and Portland cement.

PATTON SHALE.

The **Patton Shale** was described by Reger[15] from its occurrence in Monroe County and so named because of its association with the overlying Patton Limestone. At its type locality it is described as a gray and rather calcareous deposit, being somewhat lenticular and varying in thickness from 10 to 20 feet and being characterized by plant fossils associated with marine fossils. This shale was not definitely recognized in the area under discussion but is believed to be represented in the southern end of the county. In the Droop Mountain Section a 5-foot red shale was noted at the base of the Patton Limestone and may correlate with this same shale in Monroe County, although no fossils were observed. From an economic standpoint it is of no importance.

[15]Ibid., pp. 483-484.

SINKS GROVE LIMESTONE.

The **Sinks Grove Limestone**, coming just below the Patton Shale, when that member is present, but otherwise just below the Patton Limestone, was first named by Reger[16] from its exposures in the vicinity of Sinks Grove in Monroe County. This same limestone is present in Pocahontas County although its development is much less prominent. It is possible that this member is often mistaken for the overlying Patton Limestone, or included with it, as in the greater amount of their exposures there is little evidence to distinguish them, and furthermore the intermediate Patton Shale is often absent.

The limestone is best developed in Little Levels District, being noted in the Droop Mountain Section, where it is a dark, hard limestone in the upper portion but becomes yellowish-gray and shaly at the base with a total thickness of 55 feet.

HILLSDALE LIMESTONE.

The **Hillsdale Limestone** was named by Reger[17] from its occurrence just east of Hillsdale, Monroe County. There it is described as being blue, hard, and massive at the top, but as containing streaks of sandy shale toward the base, while throughout its mass from top to bottom the calcareous portions have abundant nodules of black chert which weather to gray, and also marine fossils which are scanty in the chert but which occur in great numbers in the limestone matrix, corals (especially **Lithostrotion**), brachiopods (including **Productus** and **Orthotetes**), bryozoa (including fenestelloids), crinoids, and gastropods having been noted. This limestone represents the lowest member of the Greenbrier Series in Pocahontas County, and is present over the greater part of the area, but apparently disappears entirely in the northern end of the county as it was not observed farther north than Clover Lick. In the area of its best exposures it is grayish-blue to dark, hard and massive, with the basal portion containing nodules of rounded and irregular jagged dark chert, with several species of marine fossils, (especially **Lithostro-**

[16] Ibid., pp. 484-487.
[17] Ibid., pp. 487-490.

tion canadense), brachiopods (including **Productus)**, bryozoa, and crinoids. Several good exposures of this limestone can be seen along the base of the Greenbrier Series outcrops paralleling the west side of the Greenbrier River. At a point along the State highway one-half mile northeast of Mill Point this Hillsdale (cherty) Limestone can be seen resting directly on the Maccrady Red Shale. (See Plates XXVII and XXVIII).

Along Swago Creek one and one-half miles northwest of Buckeye at the limestone quarry operated by the county on the land of Withrow McClintock, the following section was measured:

			Feet.
Concealed			
Limestone, light-gray, crinoidal	5′		
Limestone, bluish-gray, massive, fairly pure (used for road material)	25		
Limestone, light-gray, weathering yellow, with geodes, and with onyx in place of the corals (Sample No. 15)	12	Hillsdale Limestone	52
Limestone, gray, massive, with nodules of black chert and abundant crinoid stems	10		
Limestone, (Warsaw?), impure, shaly, earthy			3
Shale, Maccrady, red			

In the McLaughlin Springs Section, measured three-fourths mile west of Edray, the Hillsdale Limestone shows a thickness of 25 feet and contains abundant nodules of grayish-black chert.

The Hillsdale Limestone is characterized by the abundance of the coral **Lithostrotion** the columns of which have become silicified and are now scattered over the Maccrady outcrops where the limestone matrix has weathered away from them.

From an economic standpoint the Hillsdale is too impure to be of use for agricultural or cement purposes but due to its hard character makes excellent material for road macadam. For this latter purpose considerable use has been made of this member locally as the quarries operated by the county are located on its horizon. Most of the large springs which emerge west of the Greenbrier River are immediately beneath the Hillsdale Limestone. (See table of Limestone Springs).

ECONOMIC ASPECTS, GREENBRIER SERIES.

The best agricultural soil of the county is found along the outcrops of the Greenbrier Series, and as a result its entire exposures are cleared and cultivated, and greatly desired by energetic farmers. The limestone belts offer quite a contrast to the almost totally uncleared subjacent Pocono formations. In some localities, however, where the topography is too steep to retain a tillable soil the land is limited to grazing but in regions where the surface is comparatively level, as around Hillsboro, no better farming lands can be found anywhere.

In the vicinity of Hillsboro the Union Limestone attains a character that classifies it as a marble.[18] (See description of Union Member, pages 177-8). Here there are large quantities of this member available which take a beautiful polish and which can be used for both decorative purposes and building stone. As previously mentioned under the description of members, there are many of the beds that make excellent material for road macadam, for which purpose they have already been quite extensively used, (See Plates LIV and LV), and some are suitable for agricultural lime and for the manufacture of cement. In Chapter XIII, under the subject "Limestone", will be found a further discussion of these economic features.

[18]Paul H. Price, Marble of Pocahontas County, West Virginia, Proc., W. Va. Scientific Society, pp....-...; 1928.

CHAPTER IX.

STRATIGRAPHY—MACCRADY AND POCONO SERIES.

GENERAL STATEMENT.

In Pocahontas County the Maccrady Series and the underlying Pocono Series, composing the basal Mississippian Period, differ widely in their physical aspects, but at the same time have certain important characteristics in common which make their discussion under the same chapter appropriate.

MACCRADY SERIES.

GENERAL ACCOUNT, MACCRADY SERIES.

The Maccrady Series, comprising those beds between the Greenbrier Series and the Pocono Series, is a distinct and well-defined stratigraphic division in the area of this report. This assemblage of rocks was originally named by Campbell[1] the "Pulaski Shale" from its exposure in the county of that name in Virginia, but as this title had been earlier applied to an Ordovician formation in New York, Stose[2] gave it the name "Maccrady Formation" from its exposure in Smyth County, Virginia. Since it has been the policy of the West Virginia Survey to avoid as far as practicable the term "Formation" in the application of names to major subdivisions, Reger[3] has substituted the term Series for that of Formation, and the same usage will be followed in this report.

The Maccrady Series at its outcrops in Pocahontas County consists of deep-red and arenaceous shale, weakly

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[1]M. R. Campbell, Geol. Soc. Am., Bull., Vol. V. pp. 171, 178; 1894.

[2]G. W. Stose, Geology of the Salt and Gypsum Deposits of Southwestern Virginia, Bull. 530, U. S. Geol. Sur., pp. 232-255; 1913.

[3]David B. Reger, Mercer, Monroe, and Summers Report, W. Va. Geol. Sur., pp. 492-493; 1926.

bedded sandstone, yellow earthy limestone, with a scanty marine fauna in the calcareous member. Its thickness varies from 25 to 75 feet, with its greatest development exposed on the flats along the State highway between Buckeye and Mill Point, where it consists largely of red, sandy shales, with an occasional streak of yellow or green shale, and with some reddish-brown sandstone at the base. At some localities the red shale is absent, being replaced by a blue calcareous shale which contains numerous irregularly shaped geodes.

In Smyth County, Virginia, the Maccrady Series is much thicker, and is described by Stose[4] as in excess of 700 feet.

SUBDIVISIONS, MACCRADY SERIES.

From the above general account of this series in Pocahontas County, a subdivision would seem inadvisable, because the most favorable region for subdivision would be that of its type locality in Smyth or adjoining counties in Virginia, where both lithologic and paleontologic characteristics are noted. With this information available there is a possibility that definite correlation of the local members with those at the type locality might be established.

TOPOGRAPHIC EXPRESSION, MACCRADY SERIES.

The Maccrady Series in Pocahontas is composed largely of shale, and is limited mostly to a narrow outcrop extending the length of the county west of the Greenbrier River, and occupying a narrow interval between the Greenbrier and Pocono Series, so that its topographic expression is usually marked by a smooth slope, or an occasional low bench. The remaining exposure, and the only one east of the Greenbrier River, is a thin red shale, noted at Blister Swamp, just beneath the Greenbrier Limestone, and has no special relief other than a very low smooth slope.

AREAL EXTENT, MACCRADY SERIES.

On Figure 8, prepared by the writer with drafting by George W. Grow, the outcrop of the Maccrady Series is de-

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[4]Gypsum Deposits of the United States, Bull. 697, U. S. Geol. Sur., pp. 283-298; 1920.

lineated. On Map II the same outcrop is shown in much greater detail and on a larger scale. As previously noted the Maccrady Series is limited almost entirely to a narrow belt west of the Greenbrier River and extending the length of the county from the Greenbrier County line on the south to a point just west of the summit cut at the Randolph County line on the north. Between the main outcrop and the Greenbrier River there is an occasional patch of the red shale which has been separated from the main outcrop by erosion and which now rests upon flats that are composed of the Pocono Sandstone. The remaining exposure and the only one east of the Greenbrier River is found in a narrow belt surrounding a limestone hill at Bayard Knob in the vicinity of Blister Swamp.

CONTACTS, MACCRADY SERIES.

The upper contact of the Maccrady Series with that of the Greenbrier Series has been discussed in Chapter VIII under the same heading on preceding pages, where it was pointed out that a disconformity of some prominence, or at least to the extent to which these beds present in Virginia do not occur in West Virginia, may be assumed. It would seem further evident that certain of the groups of the Mississippian as found in the central and middle-western States are lacking in this area as well as in southern West Virginia, depending, however, to some extent on the age of the Maccrady which has not been finally settled.

At its lower contact the red shales rest disconformably on the Pocono Series, with the latter decreasing in thickness from approximately 600 feet at Marlinton to 60 feet along the Staunton and Parkersburg Pike west of Durbin, so that the known disconformity between the two series is further increased.

FOSSIL LIFE, MACCRADY SERIES.

In Pocahontas County no fossils were observed in the red shale proper nor in the calcareous blue shale that appears to have replaced the reds in some localities. In fact no collections were made from this series, but a few fossils were

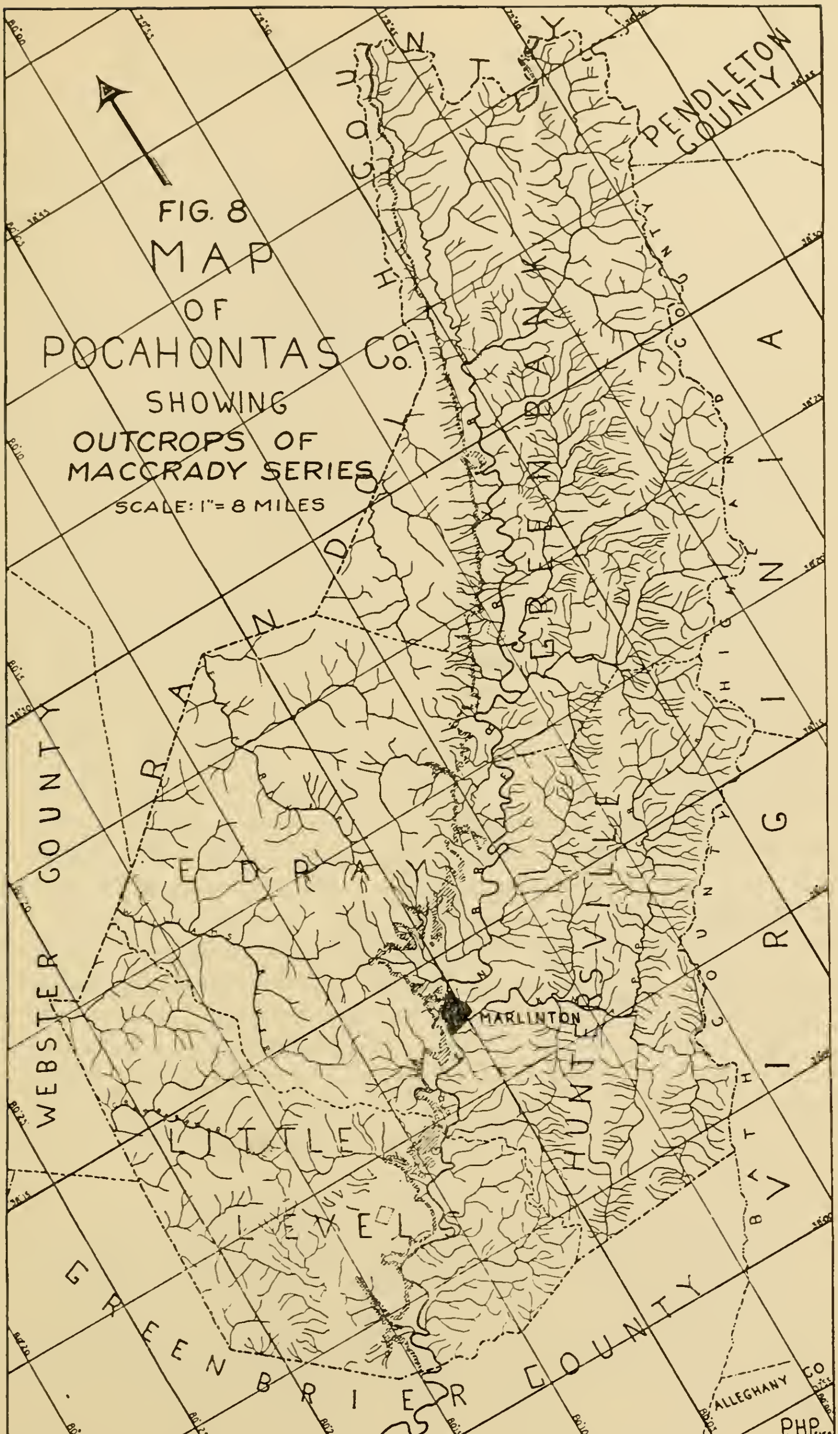
FIG. 8
MAP
OF
POCAHONTAS Co.
SHOWING
OUTCROPS OF
MACCRADY SERIES
SCALE: 1" = 8 MILES
PENDLETON COUNTY
WEBSTER COUNTY
GREENBRIER COUNTY
ALLEGHANY CO.
VIRGINIA
MARLINTON
LITTLE LEVEL
HUNTERSVILLE
EDRAY
PHP.

noted in the yellow earthy limestone just beneath the Hillsdale member of the Greenbrier Series.

CORRELATION, MACCRADY SERIES.

In view of the preceding comment, the proper correlation of the Maccrady Series with the Mississippian of southern, central and middle-western States remains uncertain. In the report in which he first names it, Stose[5] says that it probably represents the lower part of the Mauch Chunk of Pennsylvania, an interpretation that can not be accepted as the Mauch Chunk Series is now known to come above the Greenbrier Series while the Maccrady comes below it.

The writer is inclined to favor the view of Girty's,[6] although he states that his opinion is based on "very unsubstantial evidence", that the Maccrady or at least that the calcareous portion of it is of **Warsaw** age. This belief is based primarily, for the present at least, (neither lithologic nor paleontologic evidence substantiates it), upon the presence of many geodes that occur in the **Warsaw Formation** in other States and Iowa in particular. Van Tuyl[7] defines geodes as rounded or nodular masses formed by the inward growth of mineral matter upon the walls of preexisting cavities. They may be either solid or hollow, depending upon whether or not the process of filling has been carried to completion.

At a point three-fourths mile west of Edray at a series of springs (McLaughlin) a detailed measurement of the strata between the Hillsdale member of the Greenbrier Series and the Pocono Series was made. The section begins with the Hillsdale Limestone and traverses southwest to the point where the water from the last spring downstream enters Dry Creek, being as follows in descending stratigraphic order:

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[5]George W. Stose, Geology of the Salt and Gypsum Deposits of Southwestern Virginia, Bull. 530, U. S. Geol. Sur., p. 233; 1913.

[6]George H. Girty, Observations on the Faunas of the Greenbrier Limestone and Adjacent Rocks, Tucker Co. Report, W. Va. Geol. Sur., p. 483; 1923.

[7]Francis M. Van Tuyl, The Stratigraphy of the Mississippian Formations of Iowa, Annual Reports, Iowa Geol. Sur., Vol. XXX, p. 305; 1923.

	Thickness. Ft.	In.	Total. Ft.	In.
Greenbrier Series				
1. Limestone, Hillsdale, cherty	25	0	25	0
Maccrady Series (Warsaw age)				
2. Limestone, light-gray, argillaceous, with appearance of soapstone	9	0	34	0
3. Shale, bluish-gray, calcareous	3	0	37	0
4. Geodes, stratum of geodes 1" to 3" thick embedded in bluish-gray shale; cavities lined with quartz crystals	0	3	37	3
5. Shale, bluish-green, calcareous, disintegrates readily	10	9	48	0
Pocono Series				

The striking similarity of the geodes found in this member to those found in the Warsaw beds of Iowa, and a marine fauna from these same beds in southern West Virginia that Dr. Girty suggests as favoring Warsaw, lead the writer to believe that they are of similar age. This conclusion has also been reached by Butts[8] in a recent paper where he separates the calcareous portion of the Maccrady and classes it as of Warsaw age.

ECONOMIC ASPECTS, MACCRADY SERIES.

From an economic standpoint the Maccrady Shales are of minor importance in Pocahontas County. The outcrop which is comparatively narrow is well adapted for agricultural purposes. Both the shales and limestone disintegrate readily and usually receive a further lime wash from the overlying Greenbrier Series, which makes a soil that compares favorably with the soils of the Greenbrier.

The red shales are suitable for the manufacture of brick and tile and will be discussed further along with the chemical analysis of this shale in Chapter XIV.

POCONO SERIES.

GENERAL ACCOUNT AND SECTION.

The Pocono Series, which comes just beneath the Maccrady, marks the basal major subdivision of the Mississippian in this county as well as in all the counties of the State and

[8]Chas. Butts, Oil and Gas Possibilities at Early Grove, Scott County, Virginia, Bull. 27, Va. Geol. Sur., pp. 3-8; 1927.

most of the adjoining States. In the area under discussion this series consists of coarse, reddish-brown sandstones, often cross-bedded and conglomeratic, with brown, bluish-gray, and occasional red, sandy shales, together with some impure and lenticular coals. A considerable variety of marine fossils is found throughout the series as well as many plant fossils. This is the oldest series of rocks that had sufficient vegetation to form coals and is often referred to as the "False Coal Measures".

The following general section, prepared by the writer from several sections, illustrates the occurrence of this series in Pocahontas County:

General Section of the Pocono Series for Pocahontas County.

	Thickness. Feet.	Total. Feet.
1. Sandstone, gray and brown, platy, alternating with gray and dark sandy shales....	0 to 61	61
2. **Coal, Merrimac or "Big Seam"**; found in southern half of county; slaty, impure, lenticular, with plant fossils............	0 to 9	70
3. **Sandstone, Broad Ford**, reddish-brown to gray, occasionally olive to green, ferruginous, usually thick-bedded, but often shaly, weathering to large concentric boulders; carries at least two zones of marine fossils (See **Lots 10 and 22**)....	20 to 150	220
4. Shale and sandstone, gray, green, or brown, and flaggy sandstones, alternating with green, olive, blue, or red and carbonaceous shales; upper part may be **Broad Ford**	100 to 220	440
5. **Shale, Sunbury**, yellowish-brown to dark, fissile and carbonaceous, alternating thin, brown to dark sandstone; frequently contains marine fossils, brachiopods, (**Lingula melie** and **Lingulidiscina herzeri**) (See **Lots 39, 44, 46, 47,** and **59**); also algae? and land-plant fossils (**Calamites?**)	25 to 50	490
6. **Sandstone, Berea**, gray or brown, coarse, usually massive but occasionally separated into olive and brown shale, and thin platy gray or brown, micaceous sandstone; contains occasional marine fossils (See **Lot 48**)....................	50 to 85	575

In the above general section, that portion coming under heading 4, and described as alternating shale and sandstone, or at least the upper portion, may belong to the Broad Ford Sandstone.

SUBDIVISIONS, POCONO SERIES.

Earlier subdivisions by Stose and Swartz[9] of the Pocono Series, as found in northeastern West Virginia, are not recognizable in Pocahontas or other southern counties of the State. The pronounced lithological characteristics have disappeared, while no faunal relationship has been definitely established. In view of this remarkable change in character, Reger[10] has applied new titles to the minor subdivisions, and his nomenclature will be followed, so far as applicable, in this report.

TOPOGRAPHIC EXPRESSION, POCONO SERIES.

The Pocono Series, containing several resistant sandstone members, is now found capping many ridges and flats. This series invariably produces a rough and rugged topography. Beginning along the eastern border of the county the basal Pocono sandstones are found on a few high knobs on Allegheny Mountain. Directly east of the Greenbrier River in Huntersville District the lower members of this series, and particularly the Berea Sandstone, cap the numerous ridges occurring between the river and the succession of prominent ranges of Pyle, Buckley, and Marlin Mountains. Directly west of the Greenbrier River, a continuous series of flats and ridges, extending from the Greenbrier County line on the south to the Randolph County line on the north, owe their existence to the resistant members of this series. Some conception of the topography of this can be had from Plates XXV and XXVI.

AREAL EXTENT, POCONO SERIES.

On Figure 9, prepared by the writer, with drafting by George W. Grow, the areal extent of the Pocono Series can be seen at a glance, along with its location, and the relative

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[9]George W. Stose and Charles K. Swartz, Pawpaw-Hancock Folio, No. 179, U. S. Geol. Sur.; 1912.

[10]David B. Reger, Mercer, Monroe, and Summers Report, W. Va. Geol. Sur., pp. 504-505; 1926.

amount of the surface that is covered by the outcrop of this series. On Map II the same outcrops are shown in much greater detail and on a larger scale. In this county the Pocono is visible in a few high knobs on Allegheny Mountain along the eastern border of the county; in a small area along the northern end of Burner Mountain near the Randolph County line; and in greater extent along the Greenbrier River. South of Clover Lick, Pocono exposures are found on either side of the river, but north of this place the main exposure is confined to a narrow belt immediately west of this stream.

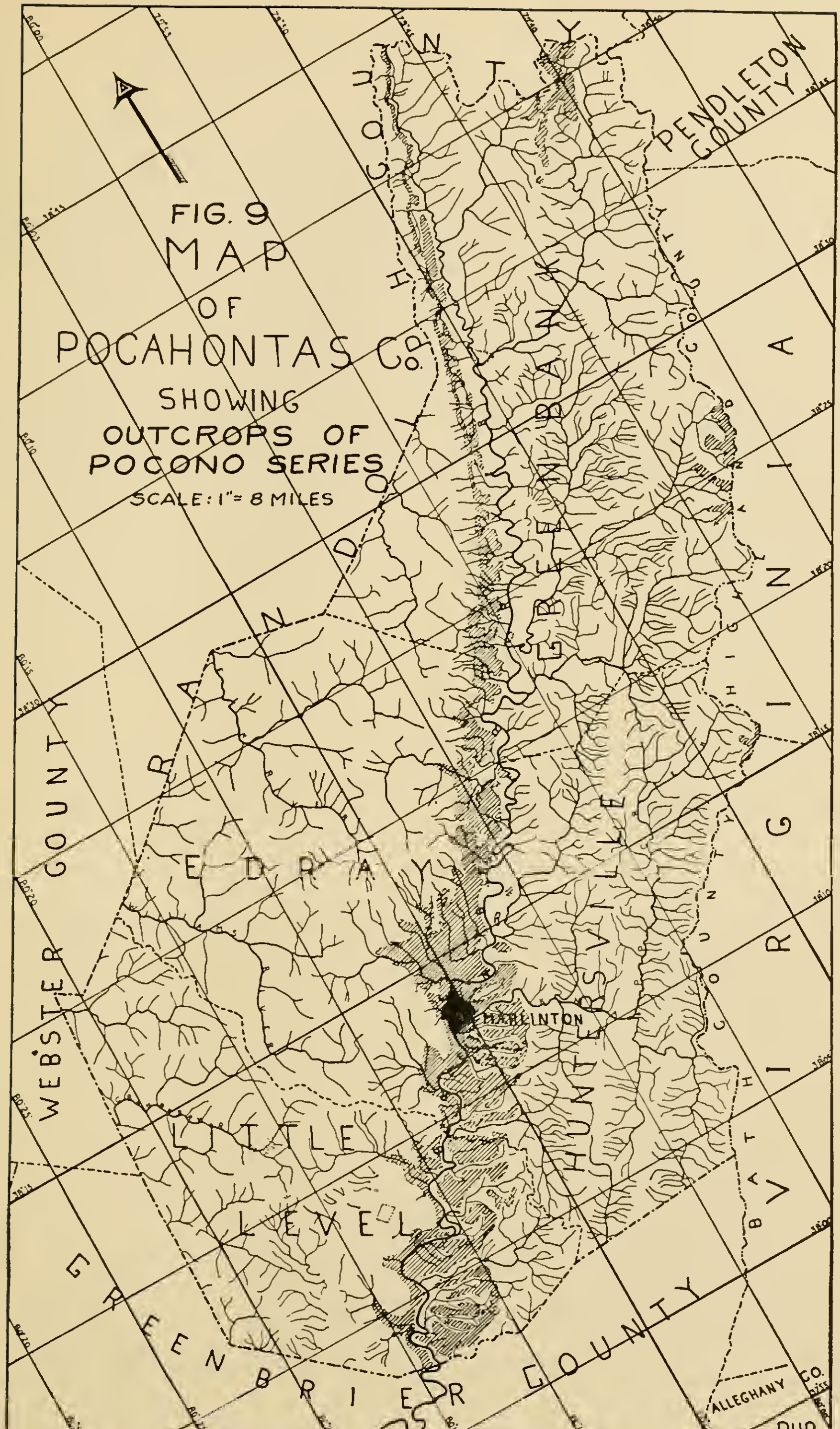
FIG. 9
MAP
OF
POCAHONTAS CO.
SHOWING
OUTCROPS OF
POCONO SERIES
SCALE: 1" = 8 MILES
RANDOLPH COUNTY
PENDLETON COUNTY
GREENBANK
HIGHLAND COUNTY
VIRGINIA
EDRAY
HUNTERSVILLE
MARLINTON
LITTLE LEVEL
BATH COUNTY
WEBSTER COUNTY
GREENBRIER COUNTY
ALLEGHANY CO.
PHP

CONTACTS, POCONO SERIES.

The upper contact of the Pocono Series with the Maccrady Series has already been discussed under the same heading in connection with the latter series. At the base of the Pocono Series, which is also the base of the Mississippian, the Catskill red shales and sandstones, which are so characteristic of this stage throughout the Appalachian States to the northeast, are still present but abbreviated by several hundred feet and also there is a marked faunal break. Owing to this fact, the lower contact is easily recognized in Pocahontas County, as the Berea Sandstone, which marks the base of the Pocono in this area, extends entirely across the county and now rests upon the red Catskill shales. Along the Chesapeake and Ohio Railway at the mouth of Stevens Hole Run the Berea Sandstone of the Pocono rests unconformably, and with slight angularity, on the Catskill red shales. Here the following local measurement was made:

		Feet.
Pocono Series (In part)		
1. Sandstone, bluish-gray, fine-grained ....20′	Berea Sandstone............	85
2. Sandstone, with white quartz pebbles...... 5		
3. Sandstone, grayish-brown, irregularly bedded 15		
4. Shale, brown, sandy; ferruginous, with quartz pebbles..... 4		
5. Sandstone, gray and brown, massive....10		
6. Conglomerate, earthy and ferruginous, with large and small quartz pebbles..... 1		
7. Sandstone, greenish-gray, micaceous, speckled with iron; weathers brown....30		
Unconformity (slightly angular)		
Catskill Series (In part)		
8. Shale, brown, sandy..............................		4
9. Shale, red, sandy..............................		8
10. Sandstone, reddish-brown..............................		5
11. Concealed		

FOSSIL LIFE, POCONO SERIES.

The Pocono Series in Pocahontas County contains both marine and plant fossils, extending from top to bottom. These fossils, however, occur largely in zones which are traceable over large areas. In the Broad Ford Sandstone there are at least two zones which are made up almost entirely of marine life, but usually so weathered that identifications are difficult. (See **Lots 10** and **22**). In southern Little Levels District numerous plant fossils are found associated with the Merrimac or "Big Seam" Coal. Lower in the Pocono column, in the yellowish-brown to dark fissile shale coming above the Berea Sandstone, is a member that probably corresponds to the Sunbury of Ohio. In this member both **Lingula melie** and **Lingulidiscina herzeri**, are found, as well as impressions that may correspond to algae and **Calamites**. (See **Lots 39, 44, 46, 47,** and **59**). In the basal Pocono or Berea Sandstone several fragmentary species of **Lingula** were noted. (See **Lot 48**).

CORRELATION, POCONO SERIES.

The Pocono Series as defined in Pocahontas County is plainly of the same age as that described under the same series in other counties of West Virginia as well as the adjoining States of Maryland and Pennsylvania on the north, even though considerable change in conditions of deposition has taken place. Beds of the same apparent age, however, in southwestern Virginia and northeastern Tennessee have been described under such titles as Price Formation and Grainger. Reger[11] is of the opinion that the New Providence Group of Kentucky is of the same age as the Pocono, which was earlier pointed out by Butts in a discussion of the Mississippian Series of eastern Kentucky.

DESCRIPTION OF MEMBERS, POCONO SERIES.

Merrimac Coal.

In central Little Levels District, along the west side of the Greenbrier River south of Mill Point to the Greenbrier County line, a coal occurs near the top of the Pocono Series

[11]Ibid., p. 512.

which possibly correlates with the **Merrimac** or "**Big Seam**", of Montgomery County, Virginia, where it has been mined for several years, and where it is described as being of semi-anthracite character with a thickness of 7 to 8 feet. Although no definite correlation has been established there seems to be little doubt that the seam prospected near Seebert, and by Calvin May along Locust Creek, 1½ miles northwest of Locust Station, is the same coal. A great deal of time and energy has been spent in prospecting this coal in the region mentioned, with but little success. Although of great scientific interest, it is the writer's opinion that this coal will not be found in sufficient thickness and purity for commercial or even local use. The following prospect is a good illustration of the occurrence of this coal:

Calvin May Prospect—No. 2 on Map II.

Little Levels District; on east side of Locust Creek, 1½ miles northwest of Locust Station and just east of Locust Creek Church; **Merrimac Coal**; elevation of top, 2150′ B.

		Feet.
1. Shale, dark-gray, with plant fossils		2
2. **Coal**, impure	0′ 3″	
3. Shale, carbonaceous	3 9	
4. **Coal**, impure	0 3	9
5. Shale, gray, slaty	3 9	
6. **Coal**, slaty, semianthracite	1 0	
7. Shale, gray, slaty		1

A sample (No. 54 P. H.) was collected for analysis from No. 6 of this section the result of which is published under No. 2 in the Table of Coal Analyses.

Several other exposures of this coal were seen, none of which appeared to be of a thickness equal to the above section, and all of which were quite impure, being lenticular and shaly. In Pocahontas County there is little hope of finding any coal in this series which could be classified as minable.

Broad Ford Sandstone.

The **Broad Ford Sandstone**, coming near the top of the Pocono, is one of the prominent members of this series in Pocahontas County and is well exposed for many miles west of the Greenbrier River. The lateral streams that flow into the main river have cut deep V-shaped valleys through the Pocono Series and now offer many excellent exposures of the Broad Ford member. This sandstone was named by Reger[12] from its exposure near the village of Broad Ford at the line between Smyth and Tazewell Counties, Virginia.

In Pocahontas County this division of the Pocono Series is largely a sandy deposit, being massive in the upper part, but often split into benches, with the lower part becoming quite shaly. It is generally reddish-brown to gray, micaceous, ferruginous, and has an upper bench which weathers into large concentric boulders, a characteristic that is traceable across southern West Virginia. It usually contains several zones of marine fossils, but in the localities where collections were made (See **Lots 10** and **22**) the fossils were so badly weathered that complete identifications were not possible. The Broad Ford, as well as the greater part of the Pocono Series, decreases in thickness to the northeast, and hence has its best development in the central and southern portions of the county. Along the Chesapeake and Ohio Railway, near the Greenbrier-Pocahontas County line, this sandstone is quite massive and forms steep precipitous cliffs west of the Greenbrier River. At Mill Point it comes at the top of the series and can be seen on either side of Stamping Creek at this village. Continuing northeast it can be seen along the State highway at nearly all points where the road begins to descend from the flats into the valleys made by the lateral streams. It underlies Kee Flats and Jericho Flat as well as those between Campbelltown and Edray.

Certain portions of the Broad Ford Sandstone are suitable for building material and have been used for that purpose at several points in the county. The stone used in the construction of many of the Chesapeake and Ohio Railway bridges was quarried from this stratum. Also, a great deal of the stone used in the construction of the Court-House, Bank of Marlinton Building, and others, was quarried from it on the eastern side of Jericho Flat.

In the general section which appears earlier in this chapter a stage of variegated shales and flaggy sandstones is noted

[12]Ibid., pp. 520-525.

coming between the Broad Ford Sandstone and the Sunbury Shale. This interval was noted particularly at Campbelltown, Marlinton (See Kee Flats Section), and Buckeye. It is possible that this succession of beds should be included in the Broad Ford Sandstone. If this were done, however, some more inclusive term, as Member or Formation, would be necessary to properly designate it.

Sunbury Shale.

The **Sunbury Shale** of Hicks[13], named from its occurrence near Sunbury, Delaware County, Ohio, where it comes between the Cayuga and Berea of the Waverly Group, is apparently present in Pocahontas County in that succession of beds coming directly above the Berea Sandstone.

In southern West Virginia Reger[14] has correlated a black, fissile and carbonaceous, or more rarely a greenish-gray and sandy deposit, varying in thickness from 25 to 50 feet and containing marine fossils, with the Sunbury of Ohio, and has traced it to his own satisfaction across West Virginia into Pennsylvania on the north, basing his conclusion on stratigraphic evidence, as well as the presence of **Lingula melie** and **Lingulidiscina herzeri**, which occur in the Sunbury of Kentucky and Ohio. This same member is found in Pocahontas County where it is a yellowish-brown to dark, fissile and carbonaceous shale, alternating with thin brown to dark platy sandstones, and containing the same diagnostic marine fauna, as both **Lingula melie** and **Lingulidiscina herzeri** were identified in collections from this area. (See **Lots 39, 44, 46, 47**, and **59**). This member is somewhat lenticular as it has disappeared in northern Pocahontas but is found to recur in other West Virginia and Pennsylvania counties to the northeast. Along the Chesapeake and Ohio Railway just east of the Fair-Grounds, this member, noted as coming just over the Berea Sandstone, attains a thickness of 35 feet. It is also exposed along the county road from a point 0.2 mile southwest of Buckeye to a bridge that crosses the main river at the latter village.

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[13]L. E. Hicks, Am. Jour. Sci., 3rd Ser., Vol. XVI, pp. 216, 220; 1878.
[14]David B. Reger, Mercer, Monroe, and Summers Report, W. Va. Geol. Sur., pp. 515-529; 1926.

Berea Sandstone.

The **Berea Sandstone** constituting the basal member of the Pocono Series and the beginning of the Mississippian Period in West Virginia, is present in Pocahontas County and is the most persistent member of that series, extending entirely across the county from north to south. This sandstone was first named by Newberry[15] "Berea Grit" from its occurrence near the town of Berea in northeastern Ohio, where it has been quarried extensively. In his original description Newberry speaks of it as a sandstone about 60 feet in thickness which varies considerably in character. In Pocahontas County this sandstone is usually grayish-brown, coarse, occasionally shaly, containing numerous quartz pebbles, and occasional marine fossils. The detailed character and thickness of this member throughout the county can be found recorded in the Stevens Hole Run, Fair-Grounds, and Durbin Sections. It is well exposed in the vicinity of Marlinton and can be seen in an almost continuous exposure from the fruit farm on top of Marlin Mountain, where the surface is now littered with quartz pebbles from this ledge, to a point in Knapp Creek one-half mile south of the mouth of Marlin Run, where it goes under drainage. It is also well exposed along the southern side of the Chesapeake and Ohio Railway 0.3 mile southeast of the Fair-Grounds. Here the following section was measured:

			Feet.
1. Shale, Sunbury			35
2. Sandstone, green, platy, fine-grained, conglomeratic near middle	25′	Berea Sandstone	65
3. Sandstone, earthy-brown, with large and small quartz pebbles	15		
4. Shale, olive-brown, alternating with grayish-brown, micaceous, platy sandstones	10		
5. Sandstone, gray or brown, cross-bedded	15		
Catskill Series			

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[15]John S. Newberry, Report of Progress in 1869, pt. 1, pp. 21, 22, 29, Ohio Geol. Sur.; 1870.

South of Marlinton the Berea Sandstone outcrops at many points along the river, and can be seen at Stillwell at 2170′ B.; one-half mile southeast of Buckeye at 2170′ B. (top); along the western bank of the river between Violet (at 2100′ B.) and the mouth of Stevens Hole Run (at 2085′ B.); and near the Greenbrier County line just west of Spice Run (Locust P. O.) at an elevation of 2100′ B.

It is also present in a series of exposures along the river northeast of Marlinton and can be seen at the following points: one mile northeast of Marlinton on the southern side of the river at 2145′ B.; along Brush Lick Run one-half mile west of August at 2200′ B.; along the county road 1½ miles southwest of Clover Lick at 2375′ B.; on either side of Glade Run one mile northwest of Clover Lick at 2350′ B.; along Elklick Run one-fourth mile west of Stony Bottom at 2400′ B.; along the Staunton and Parkersburg Pike 1¼ miles northwest of Durbin at 2250′ B.

ECONOMIC ASPECTS, POCONO SERIES.

From an economic standpoint the Pocono Series is of minor importance, there being no coals of minable thickness, and the sandstones producing a soil that is better fitted for timber growth than for cultivation. As noted under the description of that member, the Broad Ford Sandstone is, in some localities, suitable for heavy masonry and has been used locally for that purpose. The shales are generally too sandy for brick or tile manufacture. Farther west in the State at least two horizons in this series, Broad Ford and Berea, often hold large quantities of both oil and gas, the character of these strata being such as to make excellent reservoirs for their retention. In this county, however, there is little hope of finding either oil or gas in these rocks, as any of the lighter hydrocarbons that may have once existed in them has been permitted to escape, on account of their frequent exposure above drainage. Some gas has been reported from the Berea in wells drilled in this county but it is exceedingly doubtful whether it will ever be found in paying quantities. A further discussion of oil and gas possibilities will be found in Chapter XII.

CHAPTER X.

STRATIGRAPHY—DEVONIAN ROCKS.

GENERAL STATEMENT.

The rocks comprising the Devonian Period in Pocahontas County retain, in general, the same characteristics as found in New York and other northern Appalachian States, so that the generally accepted standard column of New York will be followed in this report. It is true that certain minor subdivisions have disappeared, while other members have considerably decreased in thickness, but at the same time the general group relationship is evident throughout. Certain additions and amplifications of other authors and organizations will be recognized under the respective headings. The Devonian of Pocahontas County has the following succession in descending order:

- Upper Devonian: (Hampshire and Jennings of U. S. Geological Survey Publications).
  - Catskill Series (400-840′)
  - Chemung Series (3000-3175′)
    - Hendricks Sandstone (conglomeratic).
    - Shales and Sandstones.
    - Valley Head Sandstone.
    - Shales and Sandstones.
    - Elkins Sandstone.
    - Shales and Sandstones.
  - Portage Series (2000-2410′)
    - Parkhead Member.
    - Woodmont Member.
      - Naples Fauna.
  - Genesee Series (100-150′)
- Middle Devonian: (Romney of U. S. Geological Survey Publications).
  - Hamilton Series (100′±)
  - Marcellus Series (500′±)
    - Shales.
    - Lower Selinsgrove Limestone.
    - Lower Selinsgrove Shale.
- Lower Devonian:
  - Oriskany Series (75-100′)
    - Huntersville Chert.
    - Ridgeley Sandstone.
  - Helderberg Series (100-300′)
    - Keyser Member.

Further comment on the nomenclature of this period will follow in succeeding pages under the description of the various subdivisions.

The Devonian of Pocahontas County will average approximately 7,500 feet in thickness and comprises more than half of the outcropping rock column, but is limited to the eastern side of the county, and almost entirely to the territory east of the Greenbrier River, the only exception being the Catskill Series which outcrops along this stream and occasionally west of it. Good exposures are usually available for most portions of the section although much difficulty is encountered in measuring these beds, as complete and continuous exposures are seldom found, because of frequent folding and duplication. Marine fossils are present in all the major subdivisions.

Figure 10, prepared by the writer with drafting by George W. Grow, shows the outcrops of the Upper Devonian Rocks, and Map II shows the same data in much greater detail, and on a larger scale.

UPPER DEVONIAN ROCKS.

CATSKILL SERIES.

GENERAL ACCOUNT AND SECTION, CATSKILL SERIES.

The Catskill Series, coming at the top of the Devonian and just beneath the Pocono Series of the Mississippian, and being the youngest rocks of the Devonian throughout the Appalachian States, is a mass of red shales interbedded with gray and brown micaceous, and massive sandstones, with occasional green and brown shales, its thickness varying from 400 to 840 feet. There is a noticeable change in the character of this series within the limits of Pocahontas County. Along the Staunton and Parkersburg Pike west of Durbin there are numerous grayish-green to brown sandstones, alternating with olive, green, and red shales, but the latter do not predominate as is generally the case. In the central part of the county the red shale again predominates, along with red and brown sandstones which often show ripple-marks. Along Knapp Creek a massive conglomerate appears (See Plate XXXI) near

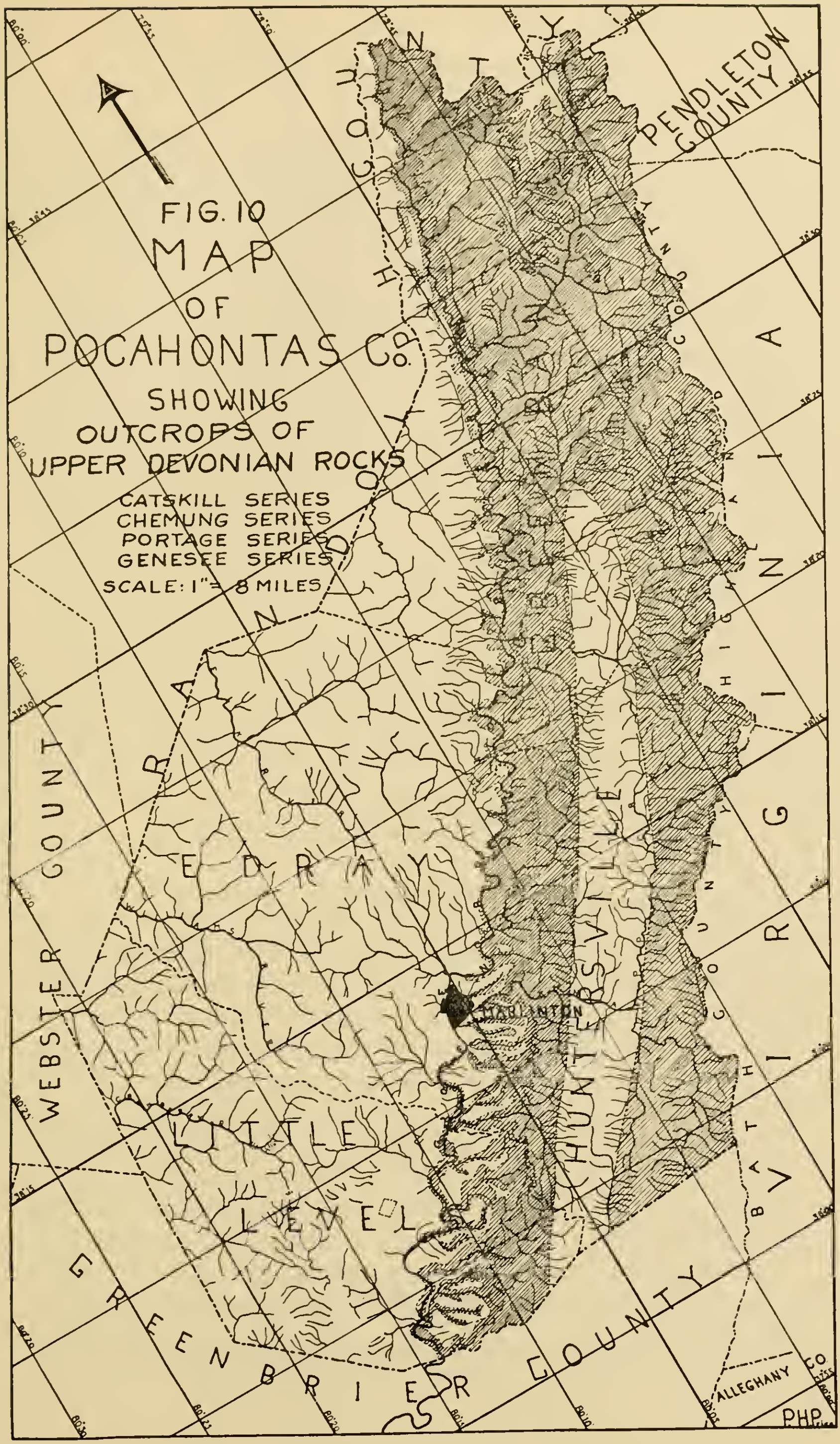
FIG. 10
MAP
OF
POCAHONTAS Co.
SHOWING
OUTCROPS OF
UPPER DEVONIAN ROCKS
CATSKILL SERIES
CHEMUNG SERIES
PORTAGE SERIES
GENESEE SERIES
SCALE: 1" = 8 MILES
PENDLETON COUNTY
HIGHLAND COUNTY
RANDOLPH COUNTY
WEBSTER COUNTY
GREENBRIER COUNTY
BATH COUNTY
ALLEGHANY CO.
VIRGINIA
EDRAY
LITTLE LEVEL
HUNTERSVILLE
MARLINTON
PHP

the middle of the series but was not noted at any other point in the county. (See Knapp Creek Section).

This series, as generally described, is typical of the Catskill Mountains, New York, and is quite general southeastward across Pennsylvania, Maryland, and West Virginia. In the latter State it thins rapidly south of the Pendleton County line and completely disappears at some point in Greenbrier County and is not recognized again in any of the southern States.

General Section, Catskill Series, Pocahontas County.

	Thickness. Feet.	Total. Feet.
1. Shales, red or green; and sandstones, grayish-brown, or greenish-brown, micaceous	0 to 25	25
2. Shale, Saxton, green, argillaceous, occasionally carbonaceous; contains plant fossils (Archaeopteris and Protolepidodendron), also brachiopods (Lingula), fish, insect, coprolites. (See Lots 40, 45, and 62)...........................	20 to 55	80
3. Shales, red and green; and sandstones, reddish-brown, or greenish-brown, micaceous, and often cross-bedded, becoming massive in northern end of county; plant fossils but no marine fossils seen..	400 to 760	840

SUBDIVISIONS, CATSKILL SERIES.

In Pocahontas as well as all other West Virginia Counties, any attempt to subdivide this series has met with little success. The greater part of the sandstones and shales are both found to be lenticular, changing from one to the other within narrow limits, so that definite correlation for any distance is quite impracticable. In recent years, however, Reger[1] has noted near the top of this series the apparent continuity of a thin, pale-green shale member which he has called the **Saxton Shale** from its occurrence near a town of that name in Bedford County, Pennsylvania. This shale contains macerated stems and foliage of plants, pelecypods, and fish teeth. A shale attaining the same general characteristics occurring

[1]David B. Reger, Pocono Stratigraphy of the Broadtop Basin of Pennsylvania, Bull., G. S. A., Vol. 38, pp. 397-410; 1927.

near the top of the Catskill in this county is recognized and is herein correlated with it. No further subdivision is considered practical in the area of this report.

TOPOGRAPHIC EXPRESSION, CATSKILL SERIES.

In localities where there are no modifying external influences like the presence of the overlying Pocono Series or distortion by abrupt folds, the topography of the Catskill Series usually resolves itself into comparatively narrow ridges with steep rounded slopes. This character is noted along the eastern border of the county, but the forms have also been influenced by the overlying Pocono beds, the greater part of which have now been removed. Just east of the Greenbrier River the topography, as represented by this series, has been influenced both by the overlying Pocono beds and by the effects of folding. Here the strata dip to the west with a resultant rugged topography lying between the Greenbrier River and the tops of Pyle, Buckley, Marlin, Thorny Creek, and Thomas Mountains, the crests of which are made by the Hendricks Sandstone.

AREAL EXTENT, CATSKILL SERIES.

Along the eastern border of Pocahontas County and joining that of Highland and Bath Counties, Virginia, the Catskill Series is retained at several points along and near the crest of Allegheny Mountain. The exposures, however, because of their location, and the generally dense cover of timber, offer poor localities for study. In the northern end of the county in that area between the East and West Forks of the Greenbrier River the same conditions prevail, few localities being observed where detailed examination could be made. Its upper and lower limits, however, were observed at frequent intervals so that its areal mapping is near the truth. It is along the Greenbrier River and along lateral streams and roads that suitable exposures for study are now found. The following exposures, extending along or near the main river and exhibiting its change in character from northeast to southwest, as mentioned under "General Account" on page

202, afford the best opportunity for study: along the Staunton and Parkersburg Pike, beginning at the river bridge at Durbin and traversing westward along this road; along the county road, beginning at the Greenbrier River at Sitlington and traversing westward to the Catskill-Pocono contact; along the highway (State route 43) beginning at the eastern side of corporate limits of Marlinton and traversing southwestward along this road to the Chemung contact (Hendricks Sandstone). This latter locality affords a complete section of the Catskill Series.

CONTACTS, CATSKILL SERIES.

The contact of the Catskill Series with the overlying Pocono of the Mississippian has already been discussed under the description of the latter series, page 194. The contact at the base of this series where it rests on the Chemung has been the subject of much discussion. The generally accepted contact has been the dividing line between the red beds and the underlying green and brown fossiliferous sandstones and shales of the Chemung. At certain localities, however, red streaks are often found interlaminated with beds of Chemung character, while olive and green shales with typical Chemung fossils have been noted well up in the red shales. It is the opinion of some authorities and particularly paleontologists, that the contact should be placed at the last recurrence of fossils regardless of the presence of red shales. If this plan were followed the areal mapping of this contact in many counties would prove to be a hopeless task. Dr. I. C. White often expressed the opinion (oral expression) that the presence of marine fossils in the basal portion of the red beds was due to the local existence of lagoons where conditions remained favorable to marine life. It is now believed by some geologists that the typical non-marine Catskill sediments of the east are contemporaneous with at least a portion of the marine sediments of the Chemung to the west. This interfingering effect of these marine and non-marine sediments is accounted for by a shifting strand line.

In Pocahontas County, as well as Randolph, Pendleton, Tucker, Hampshire, Hardy, Mineral, and Grant Counties, a grayish-brown, and massive persistent sandstone conglomerate occurs near the base of the typical red shales and near the top of those beds that are characteristic of the Chemung. The sandstone named Hendricks by Reger and Price[2], from its occurrence near the town of that name in Tucker County, offers what is probably the most satisfactory boundary between these two series in any of the above areas. Because it often contains fossils of Chemung age, it is placed in that series with the contact coming immediately above. It is easily followed in the field and affords a good key-rock for areal mapping.

FOSSIL LIFE, CATSKILL SERIES.

The greater part of the Catskill Series, and particularly the red shales, remain true to form and contain few if any records of preexisting life. Numerous plants, however, are noted at different horizons in the series but are generally poorly preserved. Plant collections from this area were made in company with Dr. David White and David B. Reger, a study of which will be made by Dr. White, but the results of his examination will not be available for this report. The upper portion of the series contains a very interesting assemblage of former life and is deserving of a more thorough examination. Along the Chesapeake and Ohio Railway opposite the Fair-Grounds a loose slab from the Saxton Shale of the Catskill Series was composed largely of fish remains, including bones, plates, and teeth. (See **Lot 45**).

CORRELATION, CATSKILL SERIES.

It is evident from the general section, as well as from discussion of the present chapter that although attenuated, the Catskill Series as found in Pocahontas County correlates with this same series throughout the Appalachian States to the northeast. It has often been designated as **Hampshire Formation** by members of the U. S. Geological Survey.

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[2]David B. Reger and Wm. Armstrong Price, Tucker County Report, W. Va. Geol. Surv., pp. 245, 251; 1923.

ECONOMIC ASPECTS, CATSKILL SERIES.

The Catskill Series from an economic standpoint is of minor importance, the soils being generally too poor for agricultural purposes, but suitable for timber growth. The shales could possibly be used for the manufacture of brick and tile, and are easily accessible at many points along the Chesapeake and Ohio Railway. The shales are also suitable for road material since they often contain sufficient sand to prevent the formation of mud, and can be used to advantage where more durable material is not readily available. The sandstones, as a rule, are too shaly and cross-bedded to be used as building stone.

CHEMUNG SERIES.

GENERAL ACCOUNT AND SECTION.

The Chemung Series of the Upper Devonian, coming just below the Catskill Series and just above the Portage Series, comprises the largest single assemblage of beds in Pocahontas County. It is composed of a mass of interbedded sandstones ranging from flags to massive ledges, alternating with green, olive, and brown shales, and it attains a thickness of over 3,000 feet. The sandstones, which are greenish-gray to brown, fine-grained, and micaceous, very hard and compact, and often lenticular, occur throughout the series.

The top member is a massive, grayish-brown sandstone **(Hendricks)**, containing numerous flattened quartz pebbles, and occasional marine and plant fossils. Near the middle of the series the sandstones become massive but occasionally shaly and sometimes contain conglomeratic beds. In the lower half of the series thin beds of limestone composed entirely of marine shells are found. Both marine and plant fossils are found in abundance throughout the series. The following is a general section of the series for Pocahontas County, being closely similar to that published by Reger for the Tygart Valley farther north:

PLATE XXXI.—Massive conglomerate near middle of Catskill Series, along Knapp Creek, 1½ miles southeast of Marlinton. (Photo. by Paul H. Price).

PLATE XXXII.—Hendricks Sandstone conglomerate marking Catskill-Chemung boundary along State route 43, 2.5 miles southeast of Marlinton. (Photo. by Paul H. Price).

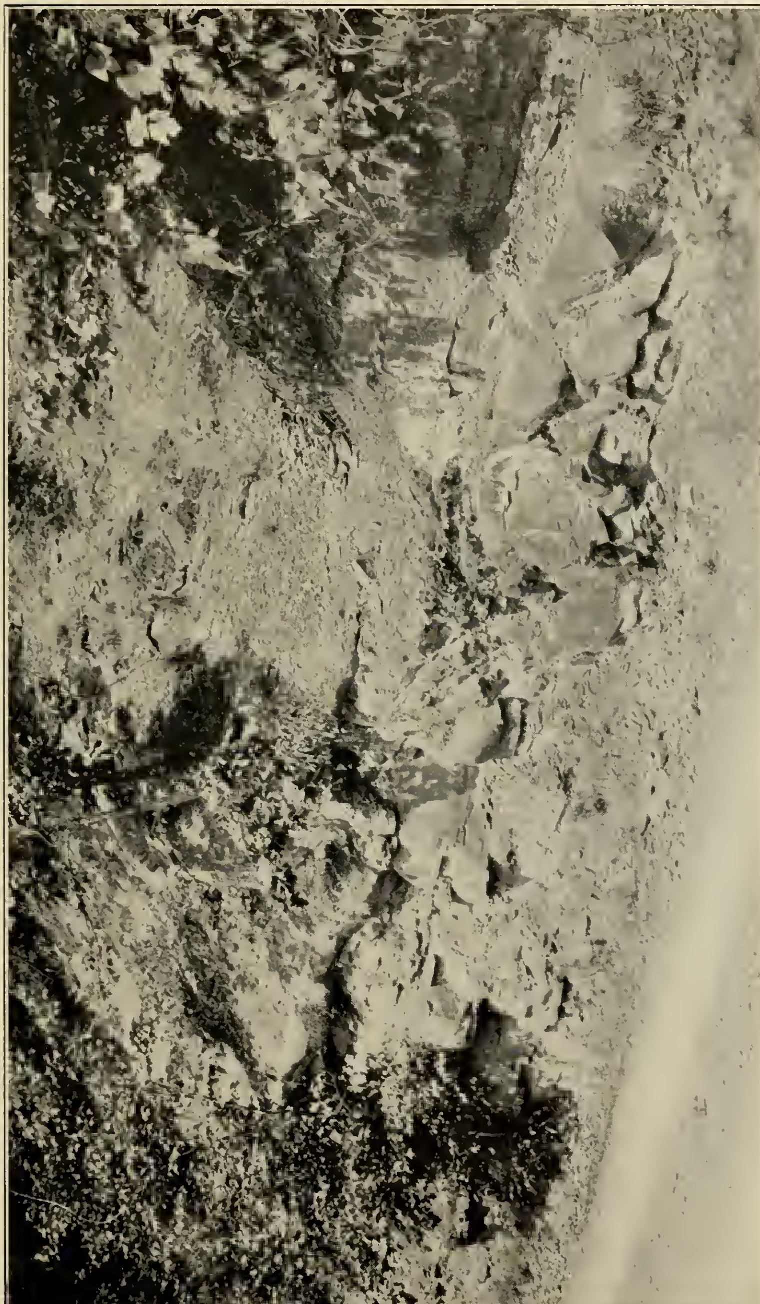

PLATE XXXIII.—Flowage or exfoliation due to pressure in Chemung sandstone, at crest of Stove Hill on Laurel Creek, along State route 43. (Photo. by Paul H. Price).

PLATE XXXIV.—View east from State route 42 north of Green Bank showing Middle and Upper Devonian topography. Allegheny Mountain is to be seen faintly in background. (Photo. by Paul H. Price).

PLATE XXXV.—Fossil Tree Horizon in Elkins Sandstone (near middle of Chemung Series) at Stove Hill, along Laurel Creek, on State route 43. (Photo. by Paul H. Price).

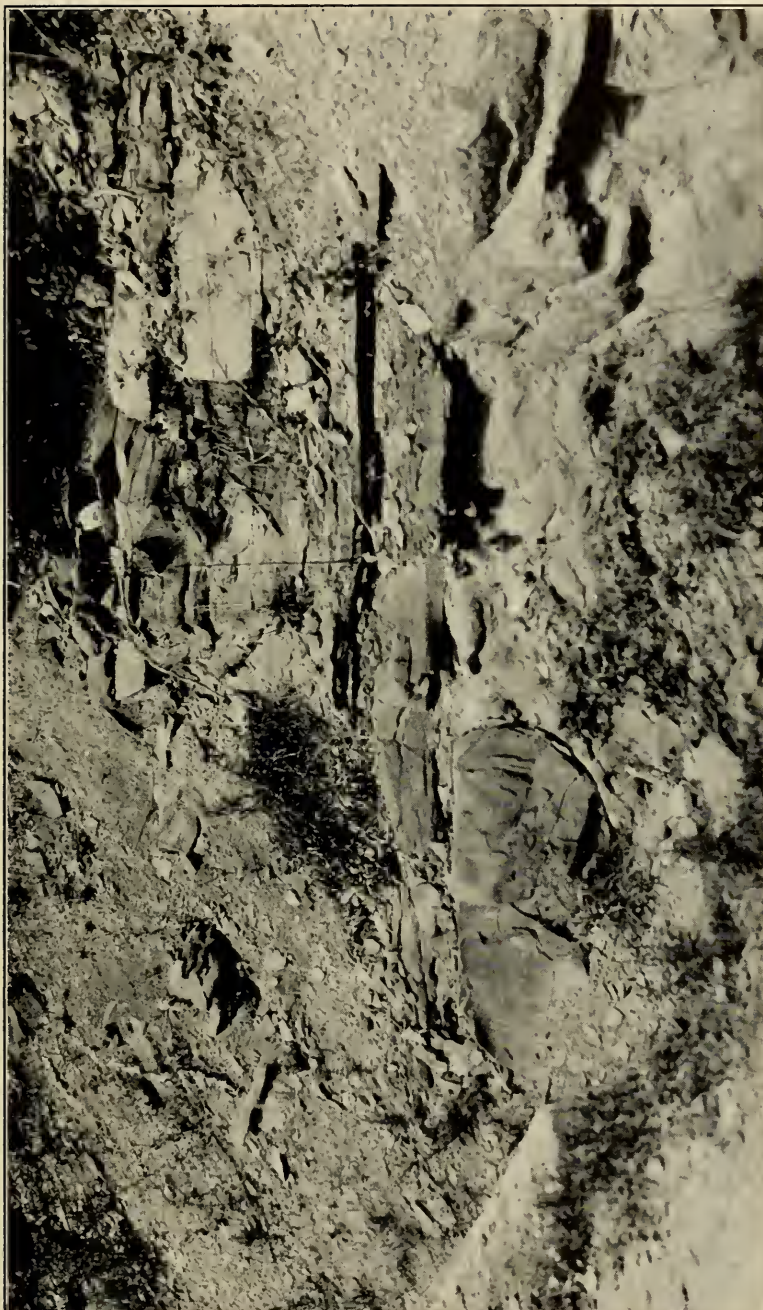

PLATE XXXVI.—Fossil Tree Horizon in Elkins Sandstone (near middle of Chemung Series), along Staunton and Parkersburg Pike (State route 56), 0.2 mile east of Durbin. (Photo. by Paul H. Price).

PLATE XXXVII.—Elkins Sandstone of Chemung Series, with Fossil Tree Horizon, along Knapp Creek, 1½ miles northwest of Huntersville. (Photo. by Paul H. Price).

PLATE XXXVIII.—Marcellus Shale containing large septarian nodules (Lime-iron concretions), on west side of Beaver Lick Mountain along Beaver Creek, 1½ miles northeast of Burr School. (Photo. by Paul H. Price).

General Section, Chemung Series, Pocahontas County.

	Thickness. Feet.	Total. Feet.
1. **Sandstone, Hendricks,** grayish-brown, weathering white, with flattened quartz pebbles and with occasional plant and marine fossils	15 to 25	25
2. Shales, green and brown, sandy; and sandstones, grayish-brown to reddish-brown, flaggy and ripple-marked, with marine fossils	200 to 300	325
3. **Sandstone, Valley Head,** olive and greenish-brown, platy, fine-grained; contains tree trunks	25 to 75	400
4. Shales, greenish-brown, sandy; and sandstones, olive, brown, and platy	600 to 800	1200
5. **Sandstone, Elkins,** greenish to reddish-brown, composed of shaly, iron-stained flags or heavier beds, separated by variegated shales; more massive at base; contains numerous marine fossils and semi-flattened tree trunks	250 to 300	1500
6. Shale, gray, green, and brown, alternating with gray and brown sandstones; heavier bedded near base; lower portion contains thin limestone composed entirely of shells; abundant marine fossils (See **Lot 35**)	1000 to 1500	3000

SUBDIVISIONS, CHEMUNG SERIES.

Owing to the lithologic similarity throughout the Chemung, attempts to subdivide it by physical appearance have been rather unsuccessful. In Pocahontas County the Hendricks Sandstone is definitely recognized and comes under the typical Catskill red shales, so that its position at the top of this series is a certainty. Beneath the Hendricks Sandstone there are from 200 to 300 feet of shales with typical Chemung aspects, near the base of which occurs a flaggy to thick-bedded, green to reddish-brown sandstone, containing fossil tree trunks. Reger[3] has named this the **Valley Head Sandstone,** from its occurrence at the village of that name in Randolph County. Beneath the Valley Head Sandstone another succession of typical Chemung shales and sandstones occurs, varying in thickness from 600 to 800 feet, at the base of which and near the

[3]David B. Reger, The Tygart Valley Devonian Trees of West Virginia, Am. Jour. of Sci., Vol. XV.; Jan., 1928.

middle of the Chemung is found a massive, grayish-brown sandstone which contains numerous large tree trunks. Reger[4] has named this the **Elkins Sandstone** from its occurrence near that city in Randolph County. This horizon occupies an interval of 250 to 300 feet. Beneath the Elkins Sandstone are gray, green, and brown, sandy shales alternating with gray and brown sandstones, and occupying an interval of 1,000 to 1,500 feet, or down to the top of the Portage Series.

Attention should be called to the occurrence of a sandstone conglomerate along Laurel Creek on State route 43, about two miles northwest of Rimel. Here a massive, reddish-brown, micaceous sandstone containing flattened quartz pebbles and dipping 25° southeastward occurs at or near the base of the Elkins Sandstone. Any attempt to correlate it with any of the Chemung conglomerates farther northeast would be of little value.

TOPOGRAPHIC EXPRESSION, CHEMUNG SERIES.

In Pocahontas as well as the remaining West Virginia Counties to the northeast, the Chemung Series, where unaffected by superjacent rocks or structural disturbances, exhibits a topographic relief that is characteristic of this series. The usual topography is that of sharp, narrow ridges with a general profile like that of an inverted V, separated by normal V-shaped valleys. When this series lies unaffected and in its normal position between the superjacent and subjacent beds, it forms a row of knobs or ridges parallel to the mountains formed by the overlying rocks, as well as to the valleys formed by the underlying and less resistant Middle Devonian shales. (See Plate XXXIV). The Chemung Series can be followed across the State to the northeast, in Randolph, Pendleton, Tucker, Mineral, Grant, Hardy, and Hampshire Counties where it forms these characteristic rows of sharp knobs and ridges.

AREAL EXTENT, CHEMUNG SERIES.

On Figure 10 prepared by the writer, with drafting by George W. Grow, the Chemung Series is outlined along with

[4]Ibid.

the remainder of the Upper Devonian Rocks, and comprises a larger areal extent than the Catskill, Portage, and Genesee Series combined. On Map II the outcrop of this series is shown in much greater detail and on a larger scale. The surface exposures of this series are limited to the eastern portion of the county and lie entirely east of the Greenbrier River. Along Allegheny Mountain the Chemung Series is extensively exposed and forms the greater part of this mountain, the younger Catskill and Pocono Series being retained along the crest at occasional high points. In the northern end of the county this series is exposed, with many reverse folds for a distance of approximately 7.5 miles along the Staunton and Parkersburg Pike. The remaining and longest continuous single exposure lies east of the Greenbrier River throughout the entire length of the county and west of those mountains included in the Browns Mountain Anticline.

CONTACTS, CHEMUNG SERIES.

The contact of the Chemung with the overlying Catskill Series has already been discussed under the description of the latter series, pages 206-7. At the base of the Chemung or at its contact with the Portage Series, the sedimentary record is not so clear. There is, however, a rather noticeable change, both lithologic and faunal, between those beds which are typical Portage and those which are Chemung. The former series is predominantly shaly and generally sparing in fossils, with flaggy or platy sandstone members which weather into rectangular blocks. The latter series contains sandstones which are much more massive, and also contains numerous marine horizons, with the guide fossil **Spirifer disjunctus** in profusion. As has been the policy of the West Virginia Geological Survey, the contact of these two series is therefore placed at the point where the flaggy and platy sandstone of the sparingly fossiliferous Portage is succeeded by the more massive sandstones, and abundantly fossiliferous Chemung. Because of the variation in the sandstones a decided break in the topography is often noted which is of great help in areal mapping.

FOSSIL LIFE, CHEMUNG SERIES.

Throughout the limits of Pocahontas County the Chemung Series carries marine fossils in profusion, and at least two fossil tree horizons along with smaller plants. Although no attempt was made to obtain a complete fossil record, numerous collections were made from this series. (See **Lots 5, 26, 28, 29, 30, 35, 42, 50,** and **52**). The identifications of these fossils along with a brief comment by Dr. John L. Tilton appear in Chapter XV, Notes on Paleontology. The guide fossil, **Spirifer disjunctus,** is probably the most conspicuous as well as the most abundant, but **Spirifer mesacostalis, Atrypa hystrix,** crinoid stems, and bryozoa are also quite common.

In the Valley Head and Elkins Sandstone horizons, similar objects to those which are classified as tree trunks by Reger[5], the affinities of which have not been definitely established, occur in Pocahontas County. These were noted at the following localities: Along the Staunton and Parkersburg Pike (State route 56), 0.2 mile east of Durbin, (See Plate XXXVI); along the Green Bank-Cass road, one mile east of Cass; along the new highway (State route 43), 1½ miles northwest of Huntersville, (See Plate XXXVII); on State route 43 along Laurel Creek, 1.2 miles northwest of Rimel (See Plate XXXV); on Little Back Creek, Highland County, Virginia.

CORRELATION, CHEMUNG SERIES.

From the above discussion it is evident that the Chemung Series of Pocahontas County correlates definitely with this same series in New York, Pennsylvania, and Maryland and retains the same general lithologic and faunal characteristics. It has often been described along with the Portage and Genesee Series under the term **Jennings Formation.**

DESCRIPTION OF MEMBERS, CHEMUNG SERIES.

Hendricks Sandstone.

The **Hendricks Sandstone,** comprising the upper member of the Chemung Series and making the lower limits of the

[5]David B. Reger, The Tygart Valley Devonian Trees of West Virginia, Am. Jour. of Sci., Vol. XV.; Jan., 1928.

Catskill red shales in Pocahontas County, was observed at several points throughout the area. It is generally grayish-brown to reddish-brown, but sometimes almost white on weathered surfaces, being massive, and containing numerous white, flattened quartz pebbles and varying in thickness from 15 to 25 feet. Occasionally it contains marine fossils along with fragments of plants.

In the northern end of the county it was noted at several points. In the Durbin Section it is a green, flaggy sandstone, containing crinoids and brachiopods, and is exposed along the Staunton and Parkersburg Pike just east of the Greenbrier River bridge at Durbin. Near Thornwood P. O. it is massive, brown, and contains numerous quartz pebbles. Along the Green Bank-Cass highway the Hendricks Sandstone is seen one-fourth mile east of the corporate limits of the latter town, and is composed of two gray and brown sandstone beds separated by 5 feet of grayish-brown, sandy shales, and contains sparse quartz pebbles. Along the highway up Laurel Run, a sandstone that corresponds to the Hendricks occurs one mile east of Clover Lick, and is a 10-foot brown stratum with quartz pebbles. This member was noted along the Staunton and Parkersburg Pike 1½ miles (air-line) north of Top of Allegheny and to the southwest along the road to Arbovale on the west side of Buffalo Ridge 3 miles (air-line) from Top of Allegheny. Along the new highway (State route 43) up Knapp Creek and 2.5 miles southeast of Marlinton it is well exposed. (See Plate XXXII). Here it is a 15-foot grayish-brown sandstone with white quartz pebbles. Its most southern exposure in this county was seen along Spice Run 0.2 mile east of the Greenbrier River.

Valley Head Sandstone.

The **Valley Head Sandstone,** named by Reger[6] from its occurrence near the village of that name in Randolph County, is present in this area although good exposures were not noted. Between 300 and 400 feet below the Catskill red shales there occurs a sandstone of Chemung character, being com-

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[6]Ibid., p. 52.

posed of olive to greenish-brown, thick flags with alternating layers of shale in which there are impressions of tree trunks, with the underside well preserved while the upper half is flat, being either eroded or compressed.

Elkins Sandstone.

The **Elkins Sandstone**, named by Reger[7] from its occurrence near that city in Randolph County, is well exposed in Pocahontas. It occurs near the middle of the Chemung Series, being composed of greenish to reddish-brown, massive sandstones and iron-stained flags, separated by variegated shales and attaining a thickness of 250 to 300 feet. Besides its profuse marine fossils it contains many impressions which Reger recognizes as fossil tree trunks. This sandstone member is well exposed at several points in this county, their location being noted under the heading "Fossil Life, Chemung Series", page 212.

ECONOMIC ASPECTS, CHEMUNG SERIES.

From an economic standpoint the Chemung Series is of minor importance. The sandstone members are generally too cross-bedded or shaly to be used for building stone, while the shales are too sandy for brick or tile purposes. There is a possibility that some of the sandstones from this series would be suitable for grindstones. Many of the flags of this series are suitable for flagstone walks, the demand for which is now on the ascendancy, the chief objection being, of course, their distance to market.

The shales weather to a thin, yellow soil, quite poor in fertility, so that their use for agricultural purposes is not extensively followed. In the area of this report the outcrops of this series seem well adapted to timber growth.

This series so far as known contains no minerals of value except in regions farther west, although its frequent pockets of iron pyrites have often caused it to be prospected for gold in mountain counties, with invariably disappointing results.

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[7]Ibid., p. 53.

To the west, southwest, and northwest, where it is deeply buried under younger rocks, there are rich deposits of gas in some of its coarser members. East of the Greenbrier River there is no possibility of its presence, as these horizons appear at the surface. West of the Greenbrier River the chances of obtaining oil or gas from this series are very slight, as will be discussed in Chapter XII under Petroleum and Natural Gas.

PORTAGE SERIES.

GENERAL ACCOUNT, PORTAGE SERIES.

The Portage Series of the Upper Devonian, coming just below the Chemung and just above the Genesee, is composed of a succession of shales and sandstones, both of which are generally greenish-gray in color. The shales predominate but slightly, and are usually arenaceous. The sandstones are rather compact, fine-grained, hard, and flaggy, and vary from 2 to 6 inches in thickness. This series was found to contain both marine and plant fossils in Pocahontas. (See **Lots 1, 31, 37, 41,** and **43**). No exposure of this series is so complete that its entire thickness could be measured, but it is approximately 2,400 feet. In the Knapp Creek Section, where the contact with the Genesee is concealed but estimated with reasonable accuracy, this series attains a thickness of 2,410 feet.

SUBDIVISIONS, PORTAGE SERIES.

In Pocahontas County there exists no basis for a subdivision of this series since it is devoid of any lithologic changes. Paleontologically, however, the fossils collected in this area show some similarity to those in more distant areas. In Maryland Dr. Swartz[8] has divided those beds lying between the Chemung and Genesee, which corresponds to the Portage, as follows:

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[8]Charles K. Swartz, Middle and Upper Devonian, Md. Geol. Surv., p. 411; 1913.

Parkhead Sandstone Member. Recurrent **Tropidoleptus carinatus** fauna.
- Shale beds.
- Conglomeratic sandstone beds.
  - **Cyclonemina multistriata** zone.
  - **Camarotoechia congregata var. parkheadensis** zone.
  - **Liorhychus mesacostale** zone.

Woodmont Shale Member.
- Beds containing Ithaca fauna. (**Spirifer mucronatus var. posterus** fauna).
  - **Liorhynchus globuliforme** zone.
  - **Cladochonus—Reticularia laevis** zone.
- Beds containing the Naples fauna. (**Buchiola speciosa fauna**).

As noted in preceding paragraphs lithologic characteristics that would warrant any subdivision in this area are absent, there being a monotonous succession of shales and flaggy sandstones, with no occurrence of conglomeratic beds. An examination of the fossils, however, reveals a similarity of the fauna of the upper half of this series to the Parkhead fauna while the lower half retains fossils characteristic of the Naples. (See **Lots 1, 31, 37, 41,** and **43**).

TOPOGRAPHIC EXPRESSION, PORTAGE SERIES.

The topography formed by the Portage Series is, in general, much like that of the Chemung, except less severe. Due to its less resistant character the ridges and slopes are more gentle and not so high. Where the strata are not greatly disturbed the more sandy ledges of the Chemung form steep ridges which are paralleled by the more gentle slopes of the Portage.

AREAL EXTENT, PORTAGE SERIES.

The areal extent of the Portage Series is included in Figure 10 under the heading Upper Devonian Rocks, on page 203. There are only two exposures, both of which are on the eastern side of the Greenbrier River and enter the county on the south on either side of the Browns Mountain Anticline and parallel this structural feature to the vicinity of Arbovale where they join in this plunging anticline to pass beneath the Chemung Series at Boyer P. O.

CONTACTS, PORTAGE SERIES.

The contact of the Portage Series with the overlying Chemung has already been discussed under the same heading in the description of that series on page 211. At the base of the Portage its contact with the Genesee is generally marked by a change from olive and greenish-gray shales and flagstones of the former to that of brown, or black and sandy, usually fissile, but sometimes slaty shales of the latter, which contain no sandstone flags; and also by the presence of typical Genesee fossils.

FOSSIL LIFE, PORTAGE SERIES.

The Portage Series throughout West Virginia to the northeast has generally been found to carry few fossils except in the eastern Panhandle where they are fairly abundant. In southern West Virginia this series contains only infrequent fossils. In Pocahontas County fossils were noted at frequent points and several collections were made, although a thorough search was not attempted. Impressions of stems of algae are noted along with several species of marine fossils and impressions of plants. (See **Lots 1, 31, 37, 41,** and **43**).

CORRELATION, PORTAGE SERIES.

The relationship of the Portage Series of Pocahontas County to its more northeastern counterparts in other States has already been touched upon under the subject of "Subdivisions". Owing to a lack of any apparent lithologic subdivisions, and to the absence of definite faunal subdivisions, it is inadvisable to make detailed comparisons in this report. Attention has, however, been called to the presence of Naples fauna in the lower portion and of Parkhead fossils in the upper.

The Portage Series occupies the interval between the Genesee and Chemung members of the Jennings Formation of the U. S. Geological Survey.

ECONOMIC ASPECTS, PORTAGE SERIES.

The Portage Series contains neither precious metals nor any other products of present economic interest. The shales are too sandy for brick purposes and the sandstones are too thin for building stone, and also weather into small blocks too small for flagstone walks. The soil is thin and poor except along the bottoms, and here the soil has been carried in and impregnated with that from other series. The soil does seem suitable for timber growth and has produced, along Knapp and Laurel Creeks, very fine white pine.

GENESEE SERIES.

GENERAL STATEMENT.

The Genesee Series, coming just below the Portage and being the basal group of the Upper Devonian, is made up of black, fissile, argillaceous shales, with occasional streaks of bluish-black limestone, followed by dark but more arenaceous beds. These beds are followed by a greenish-gray arenaceous shale with occasional thin sandstone bands. In physical appearance the Genesee resembles the Marcellus but on close examination exhibits a difference, being harder, more arenaceous, and having a slaty cleavage. The thickness of the Genesee varies from 50 to 150 feet and may be even greater, but complete exposures are not available for accurate measurement.

SUBDIVISIONS, GENESEE SERIES.

The Genesee Series has not generally been subdivided, being considered as an individual lithologic unit. In Grant County, however, Prouty[9] recognizes two divisions of this series, a lower and black, argillaceous and carbonaceous shale, and an upper portion of more arenaceous and thin-bedded sandstone. On detailed examination these general divisions are noted in Pocahontas County.

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[9]W. F. Prouty, Hampshire and Hardy Report, W. Va. Geol. Surv., pp. 323-324; 1927.

TOPOGRAPHIC EXPRESSION, GENESEE SERIES.

The Genesee Series, in conjunction with the underlying shales of the Hamilton and Marcellus, is usually found in comparatively narrow valleys or lowlands. Its upper portion is more sandy, is slightly more resistant, and forms a gentle sloping topography between the Middle Devonian shales and the overlying Portage Series.

AREAL EXTENT, GENESEE SERIES.

On Figure 10, the areal extent of the Genesee Series is included under that of the Upper Devonian Rocks, but is delineated on Map II in much greater detail and on a larger scale. Its thickness is so small in comparison to that of the Upper Devonian that its area of outcrop is very limited. Its exposures are confined to the area east of the Greenbrier River, and limited to two narrow outcrops paralleling either side of the Browns Mountain Anticline, from the Greenbrier County line to the general vicinity of Arbovale, where they unite on the northern end of this structural fold to pass beneath the Portage Series.

CONTACTS, GENESEE SERIES.

The upper contact of the Genesee with the Portage Series has already been discussed in connection with the latter series on page 217. At its base it rests upon the Hamilton Series which is poorly exposed in Pocahontas County. For some time the writer was uncertain whether or not the Hamilton Series was present at all, but certain collections **(Lots 13** and **27)** made from a bluish-brown arenaceous shale, at points where this series should occur, contain characteristic Hamilton fossils. The lower contact is therefore placed at the base of the black carbonaceous, fissile shale, with thin limestones, containing a Genesee fauna and at the top of a bluish-brown arenaceous shale with a sparse Hamilton fauna.

FOSSIL LIFE, GENESEE SERIES.

The most common fossils in the Genesee are pelecypods, cephalopods, and pteropods. The most abundant species are:

Pterochaenia fragilis, Buchiola retrostriata, Styliolina fissurella, and **Bactrites aciculus.** These species apparently range through the series. Several collections were made the identifications of which along with a brief comment by Dr. John L. Tilton appear in Chapter XV, Notes on Paleontology. (See **Lots 11, 14, 15, 16,** and **63**).

CORRELATION, GENESEE SERIES.

The Genesee of Pocahontas County retains the same general character, both lithologic and faunal, as this same member of the Jennings Formation of New York, which is the type locality of the Genesee, and can definitely be correlated with it. It has been recognized and described in other Appalachian counties of West Virginia as well as in Maryland, Pennsylvania, and New York.

DESCRIPTION OF MEMBERS, GENESEE SERIES.

As previously stated the Genesee is generally considered as a single unit with no distinct faunal break by which it might be subdivided. Even though there is a gradual change from predominantly shaly material at the base to sandy beds at the top the transition from one to the other is not sufficiently abrupt to warrant further subdivisions. This is also further emphasized by the range of typical Genesee fossils throughout.

ECONOMIC ASPECTS, GENESEE SERIES.

From an economic standpoint the Genesee is of minor importance. It is possible that a portion of these shales would prove suitable for building brick or as a flux with limestone for the manufacture of Portland cement. These shales have frequently been prospected for coal but so far as known no coal has ever been found associated with them. The soils from these weathered shales are usually quite thin and barren and unsuitable for cultivation. The more sandy portions make excellent road-surfacing material where more durable stone is not available.

MIDDLE DEVONIAN ROCKS.

GENERAL STATEMENT.

The Middle Devonian Rocks, as indicated by the classification adopted for the Devonian in Pocahontas County, includes the Hamilton and Marcellus Series, with a combined thickness that probably varies from 400 to 600 feet. The lower portion is largely a carbonaceous shale containing thin and impure limestone and calcareous shales with large lime-iron concretions, while the upper portion is composed of bluish to greenish-brown sandy shales.

The Maryland Geological Survey, following the usage of the U. S. Geological Survey, includes all the rocks in the Middle Devonian under the name **Romney** but recognizes the subdivisions Onondaga, Marcellus, and Hamilton, in ascending order. This grouping simplifies greatly the mapping, and would be appropriate in this area, since it is extremely difficult to draw exact lines between the Marcellus and Hamilton in areas where the rocks are of low dip.

Figure 11, prepared by the writer with drafting by George W. Grow, shows the areal extent of the Middle Devonian rocks, while on Map II the same rocks are shown as the Hamilton and Marcellus Series in much greater detail and on a larger scale:

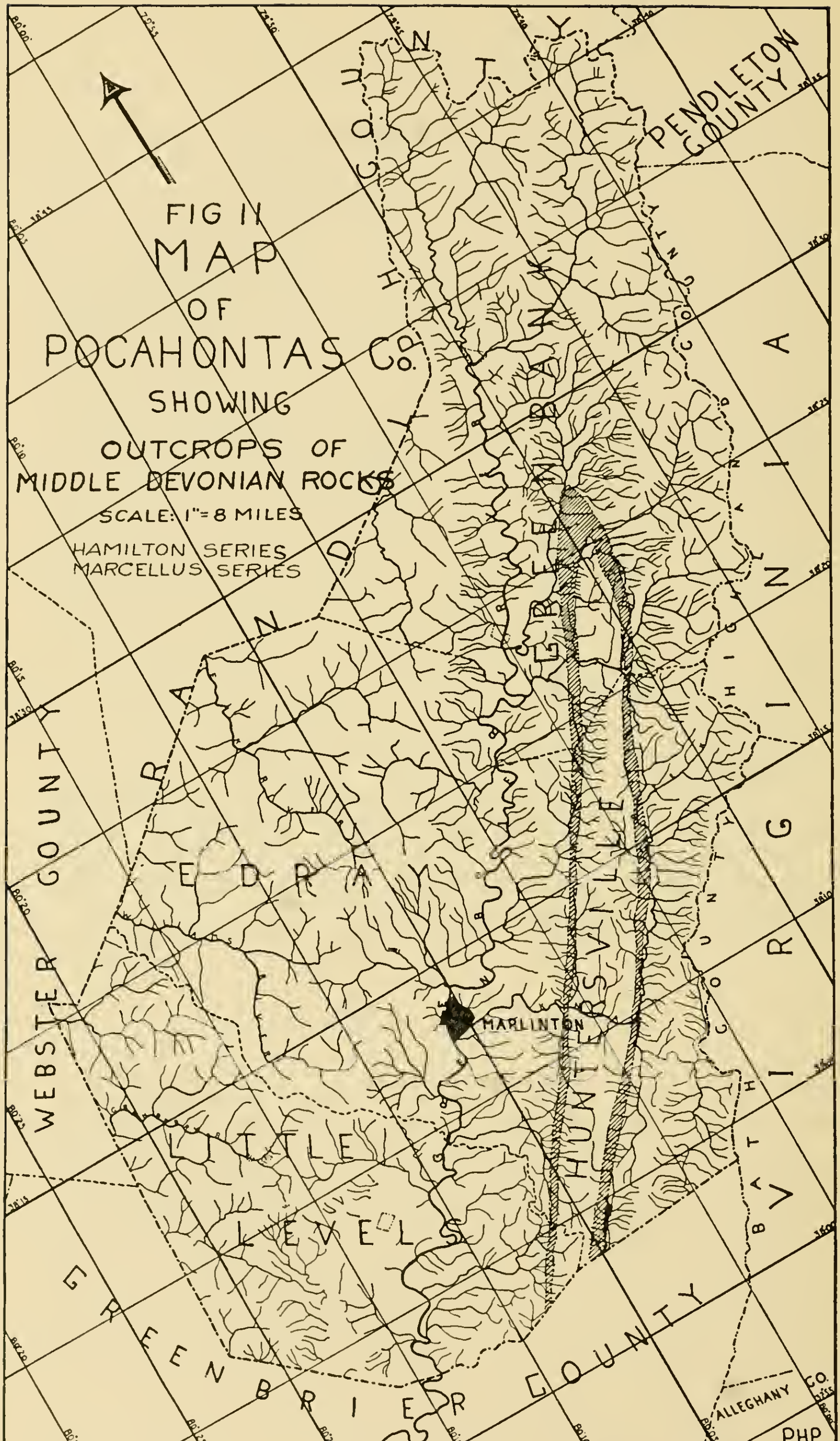

FIG 11
MAP
OF
POCAHONTAS Co.
SHOWING
OUTCROPS OF
MIDDLE DEVONIAN ROCKS
SCALE: 1" = 8 MILES
HAMILTON SERIES
MARCELLUS SERIES

HAMILTON SERIES.

GENERAL ACCOUNT, HAMILTON SERIES.

The Hamilton Series, comprising the upper division of the Middle Devonian beds, and coming just below the Genesee Series, is composed very largely of greenish-gray shales in the fresh exposures but generally weathers to a chocolate-brown or brownish-buff. The lower or more carbonaceous shales weather gray like the Marcellus below. In fact the actual occurrence of this series in Pocahontas County was so uncertain that several collections were made from its supposed horizon in order to prove or disprove its presence, with the result that approximately one hundred feet of these shales as above described contained fossils that are evidently of Hamilton age. On the basis of these identifications this succession of beds coming between those definitely recognized as Marcellus and Genesee is mapped and discussed as the Hamilton Series.

SUBDIVISIONS, HAMILTON SERIES.

From the few exposures that are recognized as Hamilton, which is apparently a single lithologic and faunal unit, subdivision by either of these characteristics was not possible.

TOPOGRAPHIC EXPRESSION, HAMILTON SERIES.

The Hamilton Series in Pocahontas contains neither resistant sandstone nor massive ledges, being composed of weak shales. It does not form prominent ridges or escarpments, and when present in nearly horizontal position makes only low and rolling hills. In this area, however, these beds are generally found standing with steep dips, but eroded to the valley bottoms along with the Marcellus.

AREAL EXTENT, HAMILTON SERIES.

The areal extent of the Hamilton Series is shown on Figure 11, under the heading Middle Devonian Rocks, along with the Marcellus Series. This same series can be seen on

Map II in much greater detail and on a larger scale. The Hamilton, like the overlying Genesee, is found only east of the Greenbrier River. Its exposures are limited to two, which enter the county on the south on either side of the Browns Mountain Anticline and parallel this structural feature to the vicinity of Arbovale where they unite in this plunging anticline to disappear beneath the Genesee Series. As noted in sections that include this horizon the interval is generally concealed. The exposure at which **Lot 13** was collected is 0.2 mile northeast of Westminster Church at elevation 2,375.

CONTACTS, HAMILTON SERIES.

The upper contact of the Hamilton Series with the overlying Genesee has already been discussed under the description of the latter series on page 219. The lower contact with the Marcellus is very difficult to draw since the beds of the lower portion of the Hamilton are very similar to those in the upper portion of the Marcellus. The line is drawn where the arenaceous shales come in above the more argillaceous and carbonaceous shales of the Marcellus. There is a marked contrast between the soils of these two series. The Hamilton weathers to a reddish-brown sandy loam while the Marcellus weathers to a gray and yields a clay soil. The absence of typical Hamilton fossils increases the uncertainty of this contact.

FOSSIL LIFE, HAMILTON SERIES.

The usual profuse marine life that is found in the Hamilton Series throughout the Appalachian States to the northeast is noticeably absent in Pocahontas County. The general absence of these fossils might cause a belief that this series is almost, if not entirely, absent in this area, but among the numerous collections made from the Lower Devonian shales two are recognized as of Hamilton age. Along the State highway (Route 42) 0.2 mile northeast of Westminster Church, **Lot 13**, collected by the writer, with identifications by John L. Tilton, contained **Coleolus tenuicinctus, Lingulella paliformis, Palaeoneilo, and Conularia undulata. Linguella**

paliformis is confined to the Hamilton in both New York and Maryland. **Lot 27,** which was collected by the writer, with identifications by Tilton, from road ballast, at the south end of the Huntersville bridge, because of its Hamilton appearance, contained **Chonetes coronatus**, **Spirifer consobrinus**, and **Ambocoelia virginiana** in abundance. The latter species is found both in the Hamilton and Marcellus, but the other two are found only in the Hamilton.

CORRELATION, HAMILTON SERIES.

In view of the foregoing discussion it seems safe to correlate that succession of beds in Pocahontas County lying between those of typical Genesee character and those of Marcellus character with the Hamilton of New York.

DESCRIPTION OF MEMBERS, HAMILTON SERIES.

Comment has already been made on the difficulty of attempting to separate the Hamilton Series in Pocahontas County into members. From the limited exposures available, few, if any, lithologic differences were noted, and from the meager fauna, subdivision on that ground would also be impossible.

ECONOMIC ASPECTS, HAMILTON SERIES.

The Hamilton Shales are of minor economic importance, containing no minerals in commercial quantities and being too sandy for general ceramic products. Although limited in quantity, the shales are admirably adapted for the construction of light-traffic roads. They seem to contain the right mixture of sand and clay for a natural road base.

MARCELLUS SERIES.

GENERAL ACCOUNT, MARCELLUS SERIES.

The Marcellus Series, coming just below the Hamilton and above the Oriskany, is composed for the most part of black, fissile shale, which becomes flaky and slickensided on compression. These shales are so black and contain so much carbon that they are frequently prospected for coal. Because of this carbon content they have a tendency to weather light colored on exposure. Toward the base of this series there occur thin impure limestones along with calcareous shales. At many localities large concretionary and septarian nodules of ferruginous and calcareous character are common. (See Plate XXXVIII). In Pocahontas County, the Marcellus Series is confined to the area comprising the Browns Mountain Anticline, and has therefore been subjected to considerable pressure by folding. For this reason it is impossible to get the exact thickness in any of the exposures visited, because of the repetition of beds by minor folding, or thinning due to lateral compression, but the Marcellus retains, in this area, an approximate thickness of 500 feet.

SUBDIVISIONS, MARCELLUS SERIES.

In conformity with previous Reports of the West Virginia Geological Survey, the Marcellus Series is subdivided as follows:

	Thickness. Feet.	Total. Feet.
Marcellus Series		
Shale, black, fissile, carbonaceous; typical Marcellus fauna and lithology..............	100 to 300	300
Limestone, Lower Selinsgrove, black, carbonaceous, shaly, carrying Marcellus and Onondaga faunas..........................	50 to 100	400
Shale, Lower Selinsgrove, black, fissile, carbonaceous, calcareous; mixed Marcellus and Onondaga faunas..........................	50 to 100	500

The Marcellus can be subdivided into an upper shaly portion and a lower calcareous and shaly portion. The lower division is variable and can usually be subdivided into an upper calcareous portion (Lower Selinsgrove Limestone), and a lower shale (Lower Selinsgrove Shale). The lower shale overlies the Oriskany Series and frequently carries large concretions, as seen on Plate XXXVIII. The Lower Selinsgrove Limestone is generally composed of thin impure beds intercalated with shales. The presence of the typical Onondaga form, **Anoplotheca acutiplicata**, can be accounted for by restricted-sea conditions in the West Virginia area in which it is found, during late Onondaga and early Marcellus time.

TOPOGRAPHIC EXPRESSION, MARCELLUS SERIES.

The Marcellus shales are the most easily eroded series of rocks exposed in Pocahontas County. The low valleys on either side of the Beaver Lick-Browns-Michael Mountain area are largely formed in this series, as well as the flat land around Green Bank and Arbovale. These bottoms are frequently covered by alluvial material.

AREAL EXTENT, MARCELLUS SERIES.

On Figure 11 the Marcellus Series is included under the Middle Devonian Rocks, but it can be seen in much greater detail and on a larger scale on Map II. This series is also confined to the east side of Greenbrier River, and to the Browns Mountain Anticline. It enters the county from the south on either side of this complex folded area and parallels this structural feature to the vicinity of Green Bank and Arbovale where its outcrop broadens by minor folding and passes beneath the younger rocks. The Marcellus Series can be seen to good advantage at many points along its outcrop. Along the Green Bank-Marlinton highway on either side of Browns and Michael Mountains many opportunities are afforded to examine it.

CONTACTS, MARCELLUS SERIES.

The upper contact of the Marcellus with the overlying Hamilton has already been discussed under the description of the latter series on page 224, attention being called to the absence of a definite plane. At the base, however, the contact is much more pronounced, with the black and fissile, typical Marcellus shale resting upon a yellowish-gray to dark sandy chert of Oriskany age. The presence of this latter chert lessens in some degree the lapse of time between the deposition of the Oriskany Sandstone (Ridgeley) proper and the base of the Marcellus, which may be contemporaneous with Onondaga, as the 50 to 75 feet of chert (Huntersville, to be discussed later) may be contemporaneous with the Schoharie or Esopus of New York. The discussion of this phase would seem to be more appropriate under the Oriskany Series.

FOSSIL LIFE, MARCELLUS SERIES.

The Marcellus Series is, as a whole, sparingly fossiliferous. Aside from the fossils occurring in the lower calcareous portion, the life forms are limited to a few species. **Styliolina fissurella** is the most common, with **Liorhynchus limitare** and a few other forms occasionally found. Since fossil collections were made primarily for stratigraphic mapping, and as the Marcellus is generally followed with slight difficulty because of its lithologic character, few collections were made from this series. **Lot 20,** collected by the writer immediately east of Cove Hill School, one mile northwest of Frost, with identifications by Dr. John L. Tilton, contained the following species: **Anoplotheca acutiplicata, Ambocoelia virginiana, Buchiola halli, Platyostoma, Styliolina fissurella,** and **Tentaculites.**

CORRELATION, MARCELLUS SERIES.

From this single collection, correlation on faunal evidence would be of little value. The upper bed of black fissile shale varying from 100 to 300 feet in thickness is without apparent lithologic variation. It is this upper portion that is limited to the Marcellus by the Maryland Geological Survey. In the lower half of the series the lithology is somewhat variable, but is generally recognized as being further subdivided into an upper and calcareous portion and a lower black shale. Kindle[10] correlates this lower calcareous portion with the Onondaga of New York, primarily on the basis of its faunal relationship. The writer is in accord with this contention, especially throughout the Appalachian States to the northeast. The presence, however, of **Anoplotheca acutiplicata** in this area,

[10]E. M. Kindle, Onondaga Fauna of the Allegheny Region, U. S. Geol. Surv., Bull. 508; 1912.

mingled with other Marcellus forms, could have been retained by restricted-sea conditions during late Onondaga and early Marcellus time. A limestone occurring at what appears to be the same stratigraphic horizon near Selinsgrove in central Pennsylvania was named the **Lower Selinsgrove** by Dr. I. C. White, but contains, according to Kindle[11] Onondaga fauna. Dr. White, however, in Report G7 of the Second Geological Survey of Pennsylvania, pages 80-81, distinctly states that the Lower Selinsgrove Limestone lies entirely above the true Corniferous (Onondaga) Limestone. This same horizon has been recognized throughout the Allegheny Mountain counties in West Virginia and correlated as such. For the sake of uniformity this same nomenclature is retained in this report.

DESCRIPTION OF MEMBERS, MARCELLUS SERIES.

Marcellus Shale.

The black, fissile, and carbonaceous shale occurring at the top of the series is generally recognized by most authors as representative of the New York Marcellus. This upper member is present in Pocahontas County and attains an approximate thickness of 300 feet and holds a scanty marine fauna in which **Liorhynchus limitare** was noted but does not appear in the only collection made.

Lower Selinsgrove Limestone.

The **Lower Selinsgrove Limestone** of White[12], coming in the lower half of the Marcellus Series and separating the upper shale from the Lower Selinsgrove Shale, was noted at several points in Pocahontas County. It is predominantly a dark calcareous shale containing dark-blue and thin fossiliferous limestone, attaining a thickness of approximately 100 feet along Deer Creek one mile southwest of Green Bank. There is a slight possibility that this excessive thickness may be due to repetition of beds, as the rocks are greatly mashed and folded in this vicinity.

[11]Ibid., p. 31.
[12]I. C. White, Report G7, Sec. Geol. Surv. of Pa., pp. 79-80; 1883.

Lower Selinsgrove Shale.

The **Lower Selinsgrove Shale** of White[13], coming below the Lower Selinsgrove Limestone, is also present in Pocahontas County, being a black, fissile, and carbonaceous shale, containing Marcellus and Onondaga fauna, and often holding numerous large concretions. This member, occurring as it does immediately above the Oriskany Series, is generally found mashed and squeezed, standing at steep dips, so that its true thickness is difficult to obtain, but it would seem to occupy an interval varying from 50 to 100 feet.

ECONOMIC ASPECTS, MARCELLUS SERIES.

The Marcellus Series weathers into a gray plastic clay soil which in itself is poor for cultivation, but is generally enriched by a wash from the adjoining hills, and locally by the presence of the Lower Selinsgrove Limestone. The local limestones, while comparatively pure, are too thin for commercial purposes, their greatest value being in additional lime to the soil in situ.

The Marcellus shales have a comparatively high carbon content from which various petroleum products may be distilled. The shales of this series burned for several days in the vicinity of Green Bank. No prospecting was done for oil shales in Pocahontas County, in the preparation of this report, but a sample was collected by the writer from this series in Hardy County, and distilled in the laboratory of Chemical Engineering at West Virginia University, which showed the presence of both oil and gas in these shales. Their value for this purpose will need to have further investigation at some future date.

LOWER DEVONIAN ROCKS.

GENERAL STATEMENT.

The Lower Devonian Rocks, composed of the Oriskany and Helderberg Series, and being the lower division of the

[13]Ibid., pp. 80-81.

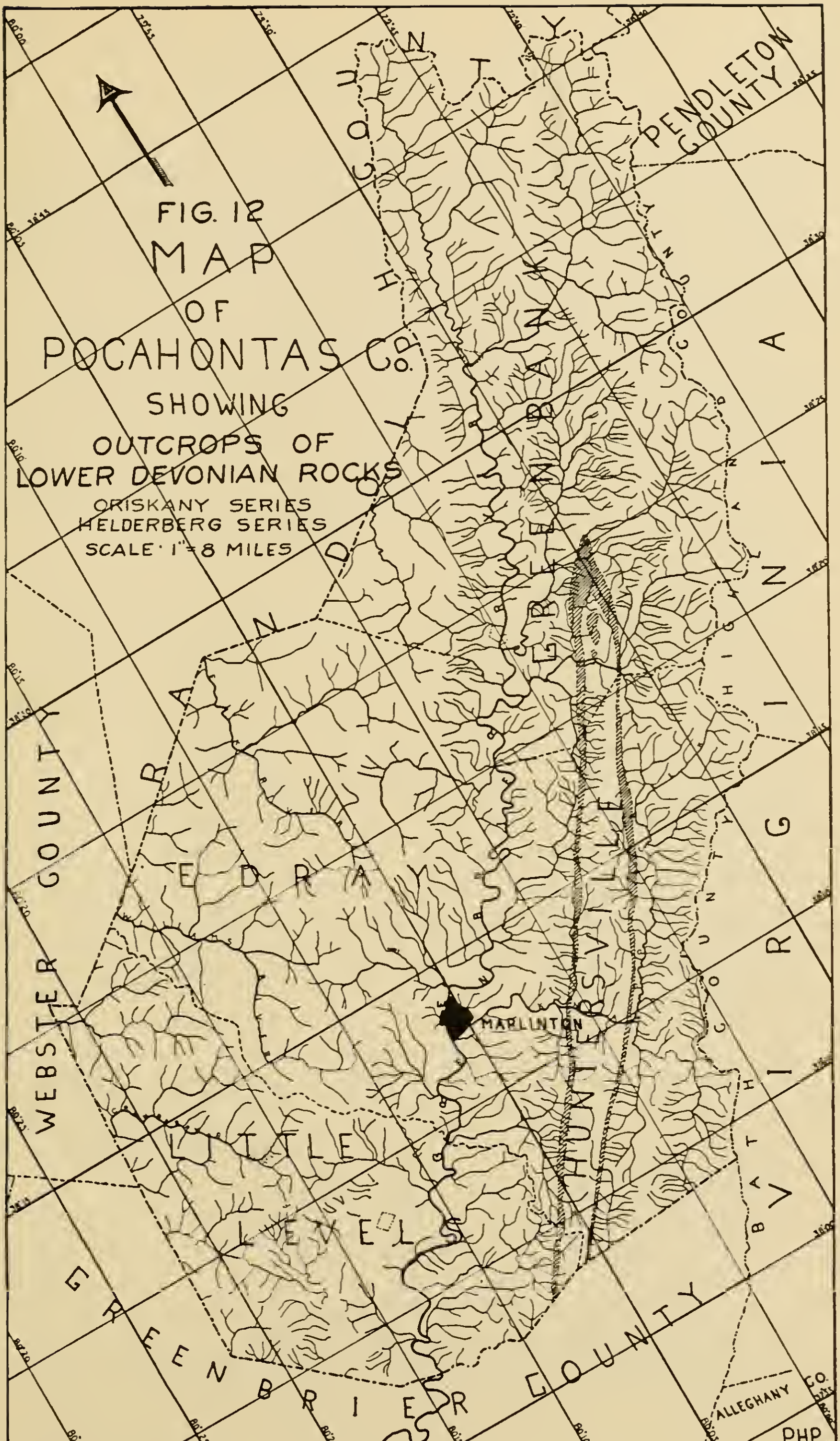
FIG. 12
MAP
OF
POCAHONTAS CO.
SHOWING
OUTCROPS OF
LOWER DEVONIAN ROCKS
ORISKANY SERIES
HELDERBERG SERIES
SCALE 1" = 8 MILES
RANDOLPH COUNTY
PENDLETON COUNTY
HIGHLAND COUNTY
VIRGINIA
GREENBANK
HUNTERSVILLE
EDRAY
LITTLE LEVELS
MARLINTON
WEBSTER COUNTY
GREENBRIER COUNTY
BATH COUNTY
ALLEGHANY CO.
PHP

Devonian System, are retained in Pocahontas County and have an approximate thickness of 400 feet. In this area a succession of chert beds that is not present in northeastern counties of West Virginia makes its appearance immediately above the sandstone member (Ridgeley). A discussion of these beds will appear in succeeding pages.

Figure 12, prepared by the writer, with drafting by George W. Grow, shows the outcrops of the Lower Devonian Rocks, while on Map II the same series are shown in much greater detail and on a larger scale.

ORISKANY SERIES.

GENERAL ACCOUNT AND SECTION, ORISKANY SERIES.

The Oriskany Series, which forms the upper subdivision of the Lower Devonian Rocks, and lies beneath the Marcellus Series of the Middle Devonian, is represented in Pocahontas County by a gray or brown, massive, coarse, ferruginous, and marine-fossil-bearing sandstone at the base, and by a succession of yellow, gray, and dark cherty beds at the top, that also contain a marine fauna of Oriskany age. The sandstone member generally contains in its upper portion a bed of small quartz pebbles which resemble rice or wheat grains. This bed has often been called the "Wheat Grain" Conglomerate. At some localities it contains pockets of iron ore with traces of manganese. The following section for the county has been compiled:

General Section of Oriskany Series for Pocahontas County.

	Thickness. Feet.	Total. Feet.
Oriskany Series		
Chert, Huntersville, yellow, gray to black, sandy, with occasional streaks of green phosphatic sandstone; contains marine fossils; Leptaena rhomboidalis and Orbiculoidea ampla, common; breaks down into 1″ to 3″ angular fragments................	30 to 60	60
Sandstone, Ridgeley, gray, brown, coarse, ferruginous; small quartz pebbles at top ("Wheat Grain"); Oriskany fauna........	25 to 75	135
Helderberg Series............................		

SUBDIVISIONS, ORISKANY SERIES.

In the above general section the rocks of the Oriskany Series have been subdivided into members according to the lithologic and faunal peculiarities that occur in Pocahontas County. The Huntersville Chert has not been noted in any of the former West Virginia Geological Survey Reports and appears to be confined, in this State, to Greenbrier and Pocahontas Counties. This member is found only east of the Greenbrier River and is confined to the Browns Mountain Anticlinal area. The Ridgeley Sandstone member of the Oriskany makes an excellent lithologic unit and has been traced south across the State from its type locality in Maryland. Although attenuated in thickness, and containing many more impurities, its general character, both lithologic and faunal, is retained throughout. The **Shriver Chert,** which is the basal member of the Oriskany Series in the Potomac region of West Virginia, is not present in Pocahontas County.

TOPOGRAPHIC EXPRESSION, ORISKANY SERIES.

With the exception of the northern extension of the Browns Mountain Anticlinal area where the strata have flattened in a plunging anticline, the outcrops of this series occur along either side of this prominent anticline and are now tilted at steep angles or slightly overturned. Under these conditions and combined with its massive, cherty, and sandy character, it is generally found making a bold topography, although few of the mountains may be attributed to this series, since its present position is in the nature of bold shoulders, paralleling the lower slopes of the ridges, the crests of which are made by the Clinton and White Medina Series. These Oriskany shoulders or "knobs" can be seen on either side of the Beaver Lick-Browns-Michael Mountain area along its entire length, and along the upper side of them will be found large deposits of chert "gravel".

AREAL EXTENT, ORISKANY SERIES.

On Figure 12, page 231, the outcrops of the Oriskany Series are shown in connection with the underlying Helderberg Series, under the title Lower Devonian Rocks. On Map II the outcrops of this series are shown by a narrow strip paralleling either side of the Browns Mountain Anticline from the Greenbrier County line to Green Bank where these separate exposures unite in this plunging anticline to pass beneath the Marcellus Series. During the last two years the Huntersville Chert member of this series has been quarried extensively for road building purposes, the openings of which now reveal many excellent exposures at these points. Along the highway (State route 42) between Green Bank and Marlinton, exposures of the Oriskany Series may be seen at the following points: one-fourth mile due east of Green Bank; one-half mile southeast of Dunmore; one mile northwest of Frost; Sherman Gibson farm, one-half mile west of Frost; at several points along the highway between Frost and Minnehaha Springs; in bed of Laurel Creek 0.1 mile southwest of hotel at Minnehaha Springs; Howard Barlow farm at Huntersville, 0.2 mile east of bridge across Browns Creek. Other good exposures were noted as follows: along Rainbow Run of Browns Creek, 0.4 mile southeast of mouth; one-half mile northwest of Burr Post-Office.

CONTACTS, ORISKANY SERIES.

The upper contact of the Oriskany Series with that of the Marcellus has already been referred to under the discussion of that series. It has been generally held that a marked hiatus existed between the Lower and Middle Devonian Rocks, based largely on an erosional unconformity reported by Darton[14] between the Oriskany and Romney (Marcellus and Hamilton) of Virginia. Kindle[15] has shown, however, in his very comprehensive report on this subject, that Onondaga faunas occur in basal Romney (Marcellus) beds. While the magnitude of the hiatus at the close of the Oriskany must be small, the occurrence of at least a short erosional unconformity at that horizon is indicated at several points by the following facts: abrupt lithologic change from Oriskany to

[14]N. H. Darton, Amer. Geol., Vol. X, 1892, p. 16.

[15]E. M. Kindle, Onondaga Fauna of Allegheny Region, Bull., U. S. Geol. Surv., No. 508; 1912.

Marcellus, the apparent erosion of the upper Oriskany at many places, the occurrence of iron deposits at the contact in several localities, its varying thickness, and the presence of a local conglomerate at this horizon. Furthermore this unconformity is strengthened by the absence of the Schoharie and Esopus Grits, which occur between the Onondaga and Oriskany beds in New York. In Pocahontas County a succession of chert beds, coming between the Ridgeley Sandstone and the black Marcellus shale, may be a recurrence of the Schoharie and Esopus, or at least contemporaneous with them. Since the fossils as reported are all of Oriskany age, these beds are classified as a member (Huntersville) of the Oriskany Series.

The lower limit of the Oriskany is easily recognized by the lithologic difference between the Ridgeley Sandstone and what is probably the Keyser Member of the Helderberg. The absence of the Shriver Chert of the Oriskany Series, and the Becraft, New Scotland, and the greater part, if not all, of the Coeymans of Helderberg age, represents a considerable time break between the deposition of the Helderberg and the Oriskany as present in Pocahontas County.

FOSSIL LIFE, ORISKANY SERIES.

The Ridgeley Sandstone member of the Oriskany was found to contain numerous marine fossil pits but too poor in character to permit identification. For this reason no collections were made from this horizon, but at several points the guide fossil, **Spirifer arenosus,** was noted. In the overlying chert member, however, sparse marine fossils were noted but in a much better state of preservation. At a point one-half mile northwest of Burr Post-Office, the following species, the identifications of which were made by Dr. Tilton, were collected: **Orbiculoidea ampla, Leptaena rhomboidalis, Schuchertella woolworthana, Diaphorostoma ventricosum, Diaphorostoma depressum.** Along with this collection two species, which probably came from the Ridgeley Sandstone, were noted in loose fragments with a sandstone matrix. They were identified as **Leptaena rhomboidalis** and **Spirifer intermedius.** The pygidia of two **trilobites** were collected by Mr. Andrew Price, of Marlinton, from the Huntersville Chert approximately 3 miles southwest of Frost and sent to the Survey office.

CORRELATION, ORISKANY SERIES.

It has already been noted that the sandstone, or lower, member of the Oriskany Series as found in Pocahontas County, correlates with the Ridgeley Sandstone member of the Potomac region of West Virginia and Maryland. The Shriver Chert member of the same region is not present in the local area. Comment has already been made on the presence of an overlying succession of chert beds that has no apparent equivalent in northeastern West Virginia or Maryland. In New York and northern Pennsylvania, however, the Schoharie and Esopus Grits are represented as coming between the Oriskany and Onondaga, or at the same stratigraphic horizon. Sufficient information, either lithologic or faunal, is not at hand to prove their equality but attention is here called to their probable relationship.

In the vicinity of Monterey, Highland County, Virginia, this same chert (Huntersville) was noted as coming immediately above the **Monterey (Oriskany) Sandstone.**

It is also possible that the Huntersville Chert may correspond with the **Jemison Chert** (Oriskany age, according to Butts[16]) of Alabama.

DESCRIPTION OF MEMBERS, ORISKANY SERIES.

Huntersville Chert.

The **Huntersville Chert** (new), coming below the black Marcellus shale that carries a sparse Onondaga fauna, and just above the massive, coarse Ridgeley Sandstone, is a yellow, gray to dark, sandy chert and contains a sparse marine fauna of Oriskany age, and varies in thickness from 30 to 65 feet. This chert on fresh exposure is tough, irregularly bedded, and breaks down into angular fragments varying in size from three-fourths to three inches in diameter.

[16]Charles Butts, Geology of Alabama, Geological Survey of Alabama, pp. 145-147; 1926.

It contains a small amount of lime and occasional streaks of blue to green phosphatic sandstone. The weathered talus from this member makes excellent road material, containing sufficient iron, lime, sand, and alumina to bind well, and has been used extensively for road building in Pocahontas County. (See Plates LVI and LVII).

The type locality of this member is in the vicinity of Huntersville where it has been quarried extensively for road material. Under the heading "Areal Extent, Oriskany Series", the localities at which the Huntersville Chert, along with the Ridgeley Sandstone, can be seen in exposures are listed.

At a point one-half mile northwest of Burr Post-Office, the following local measurement was made:

			Thickness. Feet.	Total. Feet.
Shales, Marcellus				
Chert, yellow, sandy	4′	Huntersville Chert	58	58
Chert, gray to black	8			
Sandstone, bluish-green, shaly, phosphatic	1			
Chert, yellow, gray, cobbly	15			
Concealed	30			
Sandstone, Ridgeley, brownish-white; fossil pits; fine quartz pebbles			15	73

Ridgeley Sandstone.

The **Ridgeley Sandstone** as found in Pocahontas County is a coarse, yellowish to earthy-brown, massive bed, quite porous and loosely cemented so that it weathers into beds of sand. It contains a considerable amount of iron, sometimes scattered throughout its mass, but occasionally segregated into stratified streaks of soft ocherous material. In Pocahontas County as well as Hampshire, Hardy, and other counties to the northeast, there occurs near the top a conglomerate, composed of small quartz grains that resemble the size and shape of rice or wheat grains. This is often called the "Wheat Grain" Conglomerate. There are numerous points at which the Ridgeley Sandstone outcrops in this area but only a few of these points offer clean exposures.

ECONOMIC ASPECTS, ORISKANY SERIES.

The Ridgeley Sandstone member weathers into a loose-grained sandstone which is easily broken down into sand. This same member has been used extensively in other areas for a glass-sand. Although no sample of this member was taken for analysis, its suitability for glass-sand, as found in this area, is somewhat doubtful, as it contains a much greater amount of impurities than it does farther northeast in West Virginia.

The Huntersville Chert, standing as it does at steep angles, breaks down readily into large deposits of chert gravel which is excellent for road surfacing. It contains sufficient lime, iron, and alumina to cement readily when subjected to the crushing effect of traffic. This same material has been used extensively on the roads of Pocahontas County in both Huntersville and Greenbank Districts, notably on State routes 42 and 43 between Marlinton and Green Bank. A sample of this chert was forwarded to the State Road Commission's Testing Laboratory at Morgantown, the results of the tests being as follows:

Report on Sample of Chert Gravel, Laboratory No. 20,703.

Road: State routes 42 and 43, Pocahontas County, Division 1.
Source: Howard Barlow Farm, Huntersville, W. Va.

Chemical Analysis.

	Per cent.
Loss on Ignition	2.38
Silica	86.62
Iron Oxide and Alumina	9.35
Calcium Oxide	Trace
Magnesium Oxide	0.99
Total	99.34
Absorption	2.37
Specific Gravity	2.44

Mechanical Analysis.

	Per cent.
Over 3″	0.0
Pass 3″, Retained on 2½″	0.0
Pass 2½″, Retained on 2″	8.8
Pass 2″, Retained on 1½″	29.6

	Per cent.
Pass $1\frac{1}{2}''$, Retained on $1''$	48.4
Pass $1''$, Retained on $\frac{3}{4}''$	7.0
Pass $\frac{3}{4}''$, Retained on $\frac{1}{2}''$	2.2
Pass $\frac{1}{2}''$, Retained on $\frac{1}{4}''$	1.6
Pass $\frac{1}{4}''$,	2.4
Total	100.0

"Should be suitable for use as a road-surfacing material."

Attention has previously been called to the presence of calcium phosphate in certain layers of the Huntersville Chert member. At no point was it found to be of commercial thickness or purity.

HELDERBERG SERIES.

GENERAL ACCOUNT, HELDERBERG SERIES.

The Helderberg Series, coming just just below the Oriskany Series and being the basal subdivision of the Devonian System in the Appalachian region, is present in Pocahontas County but is generally quite insignificant as compared to its much greater development throughout the region to the northeast. The Helderberg is essentially a limestone formation. Its lithologic character varies not only in different beds but also in the exposures of different regions. It ranges in color from light-blue to dark-gray and in texture from a massive and nodular limestone to a calcareous shale. The thickness of the Helderberg varies from 150 to 300 feet.

SUBDIVISIONS, HELDERBERG SERIES.

In Maryland, where the Helderberg has been extensively studied, it is divisible into four members on both lithologic and faunal grounds. These members in descending stratigraphic order are as follows:

Becraft Member.
New Scotland Member.
Coeymans Member.
Keyser Member.

In passing southwestward from Maryland into West Virginia, there is a general thinning of the Helderberg. So far as known the Becraft Member is not present in West Virginia and is recorded in only one county in Maryland. In Pendleton County the New Scotland Member is only 12 to 15 feet in thickness, while the Coeymans is present with a variable thickness. In Pocahontas County none of the upper three members, Becraft, New Scotland, nor Coeymans, was recognized as being present, and the Helderberg is therefore apparently limited to the Keyser Member.

TOPOGRAPHIC EXPRESSION, HELDERBERG SERIES.

The Helderberg Series is generally found in steep dips, and being massive and nodular, forms comparatively high and steep slopes in conjunction with the superjacent Oriskany Series. In this region it has been so influenced both by associated formations and by the effects of folding that its normal topographic development can not be accurately ascertained.

AREAL EXTENT, HELDERBERG SERIES.

The areal extent of the Helderberg Series is shown on Figure 12, along with the Oriskany Series, as the Lower Devonian Rocks. It is also shown on Map II in much greater detail and on a larger scale. Its exposures are in general the same as those of the overlying Oriskany and are limited to the eastern side of the county. Its outcrops are confined to the eastern and western limbs of the Browns Mountain Anticline, paralleling either side of this structural feature from the Greenbrier County line on the south to their northern limits at Green Bank where they unite in this plunging anticline to pass beneath the Oriskany. The best exposures that were noted are as follows: on either side of Sitlington Creek one-half mile east of Dunmore; along State route 42, just west of the highway bridge across Knapp Creek, 1¼ miles southwest of Frost; along Rainbow Run of Browns Creek 0.4 mile southeast of the mouth of the former stream; along highway 0.3 mile southeast of Huntersville. Other exposures were noted but are too poor for detailed study.

CONTACTS, HELDERBERG SERIES.

The upper contact of the Helderberg Series with the Oriskany has already been discussed under the same heading in the description of the latter formation. The lower limit has long been the subject of many lengthy papers and discussions. In the local area conditions are not favorable for a detailed study of this question, the exposures being few and poor. In conformity with former studies of this contact, with particular reference to the northeastern counties of West Virginia, the boundary that seems best fitted is the plane between the more massive limestones of the Helderberg and the more flaggy and purer beds of the Bossardville. This division seems best adapted on both lithologic and faunal grounds, although certain species of Silurian age are found to exist on into the Helderberg.

FOSSIL LIFE, HELDERBERG SERIES.

The Helderberg Series was found to contain several different species of marine fossils, but only two collections were made from this horizon. A conspicuous feature of the Keyser Member is the existence in it of a reef of corals and stromatoporoids. They are usually very resistant and generally stand in relief with the adjacent strata, the weathered stromatoporoids presenting a curly and knotted appearance. Other fossils noted were ostracods, brachiopods, gastropods, and bryozoa. (See **Lots 2 and 54**).

CORRELATION, HELDERBERG SERIES.

Attention has already been called to the absence of the Becraft and New Scotland Members and probably the Coeymans Member of the Helderberg Series as found in the Potomac region of West Virginia and the adjoining State of Maryland, leaving only the Keyser Member of this series in Pocahontas County. The presence of both the lithologic and faunal characteristics of the Keyser Member of the Helderberg as described by the Maryland Geological Survey at its type locality at Keyser, Mineral County, West Virginia, would seem to establish its correlation with that member beyond doubt. In many publications, and particularly the

U. S. Geological Survey Folios, the Helderberg Series is included under the description of **Lewistown Limestone.**

DESCRIPTION OF MEMBERS, HELDERBERG SERIES.

As already noted the Helderberg of Pocahontas County appears to be limited to the Keyser Member, the upper contact, however, generally being concealed so that there does exist a slight probability that some portion of the Coeymans might be present. The writer is of opinion, however, that the upper three members of this series as described in Maryland are absent. The general description at the beginning of the Helderberg discussion does not fully portray the true character of this series in this area, so that local measurements of this succession of beds will follow:

Local Measurement, Helderberg Series (in part).

Huntersville District; along State route 42, just west of highway bridge across Knapp Creek, 1¼ miles southwest of Frost.

	Thickness. Feet.	Total. Feet.
Concealed		
Limestone, dark-blue, knotty	10	10
Limestone, bluish-black, siliceous, massive; stromatoporoids	5	15
Limestone, dark, siliceous, cobbly	15	30
Limestone, gray, platy	15	45
Concealed		

Local Measurement, Helderberg Series (in part).

Huntersville District; along north side of Sitlington Creek, beginning one-half mile east of Dunmore and traversing up said creek until beds reverse dip.

	Thickness. Feet.	Total. Feet.
Concealed		
Limestone, bluish-gray, massive; stromatoporoids, **Favosites**, cup corals, crinoid stems	20	20
Limestone, argillaceous, with calcareous shales and sandstone	40	60
Limestone, siliceous	3	63
Limestone, nodular, shaly	7	70
Limestone, sandy, pitted	5	75
Limestone, platy, shaly, very sandy	20	95
Limestone, dark-blue, cherty	5	100
Limestone, cobbly	10	110
Limestone, (near Bossardville contact), bluish-gray, platy, laminated	25	135
Concealed		

In the bed of Rainbow Run, one-half mile east of where it enters Browns Creek, the Helderberg Series is composed of beautifully colored laminated clays. Here the rocks are standing at steep dips so that the water passes over the strata at nearly right angles to the bedding. The clays are very finely laminated and vary in color from yellow, red, purple, and lavender, to white, and produce a striking appearance when seen through the clear stream water. Samples of the clays were taken for analysis (Nos. 7 and 8), the results of which appear under Clays.

ECONOMIC ASPECTS, HELDERBERG SERIES.

Some of the lower beds of the Helderberg Series are of sufficient thickness and purity for lime-burning or for the manufacture of Portland cement. Although the land on which this series outcrops is generally rough, it retains a soil that is adaptable for cultivation, fruit trees, or grazing. It is from the base of this series or near its contact with the Bossardville Group that several fine springs emerge in this county, a characteristic that seems to hold in other West Virginia counties to the northeast.

CHAPTER XI.

STRATIGRAPHY—SILURIAN ROCKS.

GENERAL STATEMENT.

The Silurian Rocks as found in Pocahontas County, West Virginia, and as indicated in the General Columnar Section, page 73, have been classified as follows, in descending stratigraphic order, with certain titles being added in parentheses to indicate supposed contemporaneous nomenclature:

	Thickness. Feet.	Total. Feet.
Salina Series		
Bossardville Group (Tentaculite, Manlius, Tonoloway)	325 to 600	600
Rondout Waterlime Group (Wills Creek)	100 to 150	750
Bloomsburg Group	25 to 0	750
Niagara Series (McKenzie)	50 to 100	850
Clinton Series (Rockwood and Cacapon of U. S. G. S. Folios; Rochester of Maryland and Clinton of New York)	500 to 600	1450
White Medina Series (Tuscarora, Albion, Clinch, of U. S. G. S. Folios)	50 to 160	1610
Red Medina Series (Juniata of U. S. G. S. and other Reports)	400 to 600	2210

From the above section it can be seen that these rocks vary in thickness from a minimum of 1,450 feet to a possible maximum of 2,210 feet. At no point was it possible to measure a complete succession of the beds in detail, because of duplication by folding, or on account of concealed intervals. but exposures of all the individual groups are available at one point or another.

The upper boundary of the Silurian is generally agreed upon as coming at the base of the Helderberg. The lower boundary or the contact of the Silurian with the Ordovician has long been a subject of debate, nor is there yet a general agreement on this point. It has been the policy of the West Virginia Geological Survey to place the base of the Silurian at the bottom of the **Gray Medina Sandstone.** As the oldest rocks exposed in Pocahontas County are the Red Medina sandstones and shales, there is no information available in this area that might throw any additional light on this controversy. In this report, however, the Medinas are considered as of Silurian age.

The Silurian as thus delimited begins in Pocahontas County with Red Medina beds, suggesting rapid deposition with poor sorting of the materials and also estuarine or land deposits. In the following epoch the beds are mainly of white sand with white quartz pebbles that represent a shore phase of a transgressing sea. As the sea deepened there followed a succession of shales and sandstones of lower and middle Clinton with numerous marine fossils. Following this the beds become more calcareous and contain abundant marine fossils, and show the effect of a retreating sea that began with the Niagara, followed by the Rondout and later the Bossardville laminated limestones.

The Silurian deposition is a good illustration of a cycle of sea inundation and retreat, marked by times of recession, slight reversals, and the separation of sea basins.

SALINA SERIES.

GENERAL ACCOUNT AND SECTION, SALINA SERIES.

The Salina Series as found in Pocahontas County is divided, following earlier subdivisions, into three main groups, the upper, or Bossardville, containing pure, platy, and laminated limestones, the middle, or Rondout, made up of interbedded calcareous shales and limestones, and the lower, or Bloomsburg, composed of platy and flaggy sandstone. This latter sandstone, being quite insignificant, is mapped with the Rondout Group.

General Section of Salina Series for Pocahontas County.

	Thickness. Feet.	Total. Feet.
Salina Series		
Bossardville Group, blue to gray, platy and brittle limestone, occasionally massive and containing calcite streaks; marine fossils..	325 to 600	600
Rondout Waterlime Group, blue to dark, hard, brittle, argillaceous limestone, weathering earthy; sparse marine fossils..............	100 to 150	750
Bloomsburg Group, grayish-brown sandstone, quartzitic, flaggy..........................	25 to 0	750

SUBDIVISIONS, SALINA SERIES.

The subdivisions of the Salina Series, as has already been noted in the general section, are the **Bossardville, Rondout, and Bloomsburg**, in descending stratigraphic order. In this area clean-cut exposures marking the respective subdivisions, such as are found in the Potomac River region of northeastern West Virginia and western Maryland, are not available. There is, in general, however, a marked contrast between the different groups of this series, but the change from one to the other is gradual rather than abrupt. The Bloomsburg Sandstone (when present) offers the greatest contrast, being a flaggy to platy sandstone, quartzitic in character, with thin streaks of dark arenaceous shale. The division between the Rondout and Bossardville Groups is much less apparent, the dark-blue and argillaceous limestones and calcareous shales of the former grading into a purer and lighter platy limestone that is laminated and often wavy, giving a ribbon effect on weathered surfaces.

TOPOGRAPHIC EXPRESSION, SALINA SERIES.

The Salina Series in Pocahontas can not be spoken of as having a characteristic topography. In this area these beds have been greatly folded, superinduced by lateral thrusts, and are now found standing at steep angles along either side of the Browns Mountain Anticline. The Salina limestones, along with the Niagara, due to their soluble character, are generally found in narrow valleys between the more resistant Lower Devonian rocks and the underlying Clinton and Medina Series.

AREAL EXTENT, SALINA SERIES.

The areal extent of the Salina Series along with the Niagara Series (the latter being mapped with the Salina because of its narrow outcrop) is shown on Figure 13 as prepared by the writer with drafting by George W. Grow. These same exposures are shown on Map II in much greater detail and on a larger scale. This series is limited to the eastern side of the county, lying east of the Greenbrier River and south of Green Bank. At no single locality can the entire series be seen but the best exposures for detailed examination are as follows: along State route 43 on either side of Sitlington Creek from three-fourths mile east of Dunmore to 1¼ miles east of Dunmore; several outcrops in the vicinity of Gum Spring School; along the road from Frost to Thorny Creek School one mile (air-line) northwest of Frost; along State route 42, one-half mile northwest of Minnehaha Springs; along State route 43, one-half mile east of Huntersville; along Rainbow Run one-half mile east of mouth; one-fourth to one-half mile northwest of Burr Post-Office.

CONTACTS, SALINA SERIES.

The upper contact of the Salina Series with the Helderberg of the Devonian has already been discussed under the latter series. At the base there usually occurs a sandstone, grayish-brown in color, somewhat flaggy and quartzitic, which marks a break in deposition from the underlying marine Niagaran limestones and shales, to the beds of the Rondout. Even this break is not as evident in this area as it is at its type locality at Bloomsburg, Pennsylvania, or in other West Virginia counties to the northeast where the Bloomsburg consists of red and green shales and sandstones containing numerous mud-cracks and other evidence of shallow-water conditions. The Bloomsburg Sandstone, when present, due to its resistant character, often forms sharp ridges or hogbacks between limestone depressions.

FOSSIL LIFE, SALINA SERIES.

The Salina Series was found to be, in general, sparingly fossiliferous in Pocahontas County. Only two collections were made from this series, both from the Bossardville Group. (See **Lots 4A and 51**). **Camarotoechia tonolowayensis** was found to be abundant along with **Camarotoechia litchfieldensis**. At a point one mile northwest of Frost on the eastern side of the Browns Mountain Anticline, two species of Coelenterata were noted in the Bossardville Group, the one

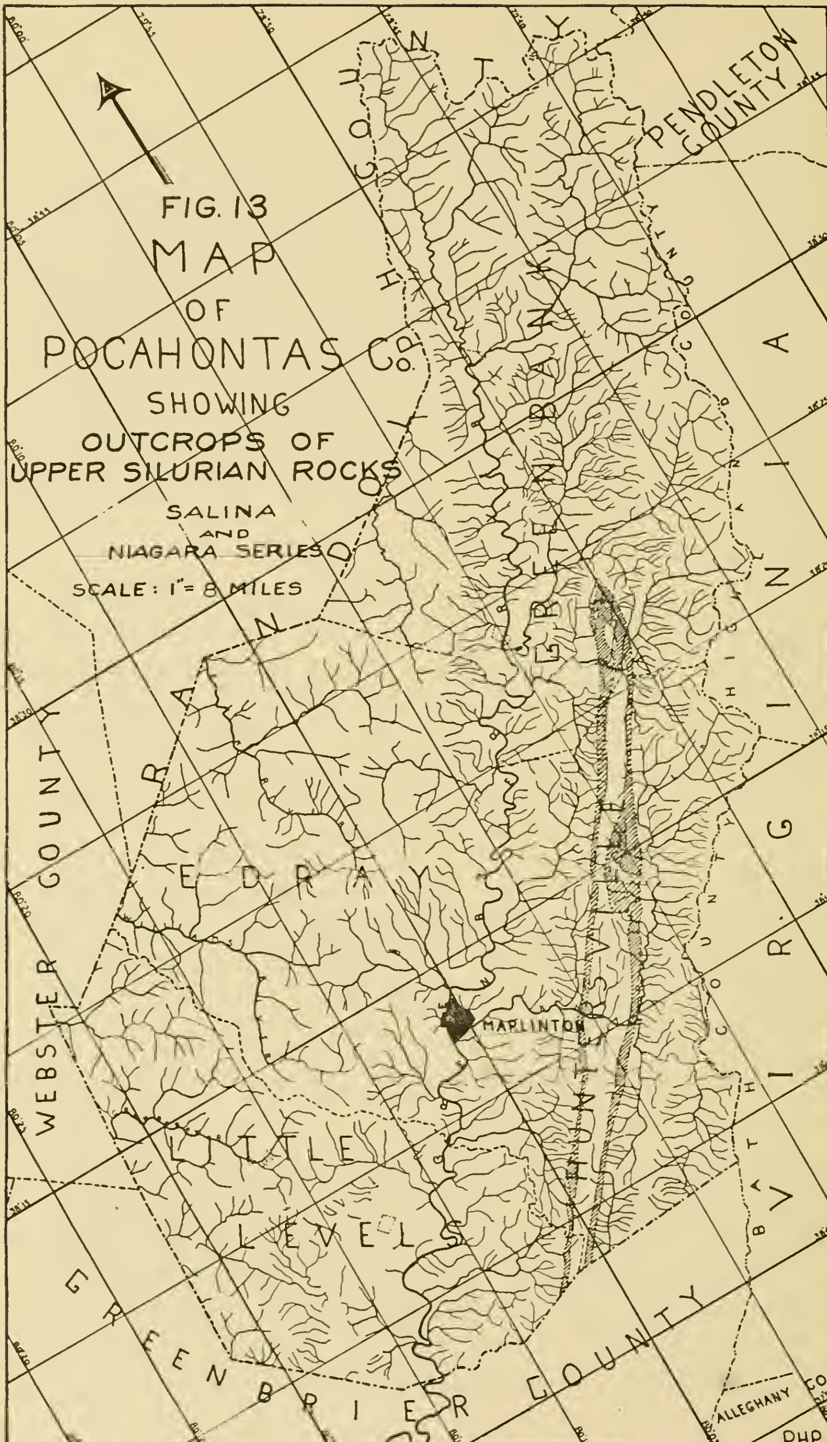
FIG. 13
MAP
OF
POCAHONTAS Co.
SHOWING
OUTCROPS OF
UPPER SILURIAN ROCKS
SALINA
AND
NIAGARA SERIES
SCALE: 1" = 8 MILES
PENDLETON
COUNTY
HIGHLAND COUNTY
RANDOLPH COUNTY
GREENBRIER COUNTY
WEBSTER COUNTY
BATH COUNTY
ALLEGHANY CO.
VIRGINIA
EDRAY
LITTLE LEVELS
HUNTERSVILLE
GREENBRIER
MARLINTON
PHP

recognized by Dr. Tilton as **Favosites niagarensis** and the other a **Favosites** with the species indefinite. The Rondout was found to be sparingly fossiliferous and those noted were so retained in the matrix as to make collecting unsatisfactory. Ostracods were noted, one species of which had the general appearance of **Leperditia alta**. The Bloomsburg Sandstone as present in this area was found to be non-fossiliferous.

CORRELATION, SALINA SERIES.

Certain relationships of the Salina Series as found in Pocahontas County with their northeastern counterparts in other States have already been suggested. More definite and detailed correlation necessitates better exposures and more numerous systematic fossil collections than are available in this area. That the upper or Bossardville Group of this series correlates with this same formation to the northeast is quite certain, and this in turn is essentially synonymous with the Tentaculite, Manlius, and Tonoloway, as pointed out by Reger in Chapter XIV of the Mineral and Grant County Report. The Rondout Waterlime Group although somewhat attenuated retains in general the same character as found at its type locality in New York, and can safely be correlated with it. This group correlates with the **Wills Creek Formation** of Maryland, and is included under the **Lewistown Limestone** in the Monterey Folio. The Bloomsburg Sandstone retains few of its original characteristics as found at Bloomsburg, Pennsylvania. This member has been traced, however, across the State to the northeast where it does conform to the description at its type locality, the typical red color disappearing south of Hardy County.

DESCRIPTION OF GROUPS, SALINA SERIES.

Bossardville Limestone Group.

The Bossardville Group is made up largely of limestone which is thin-bedded and laminated. These thin beds of laminated limestone are often separated by thin shale partings, so that limestone slabs weather out and frequently cover the surface slopes in the area of the outcrop, so that it is easy to distinguish this formation at some distance. These slabs or fragments often have a noticeable cleavage, and break in rough geometric figures. Certain beds carry an abundance of fossils of few species. In the general section this group is shown to range from 325 to 600 feet in thickness. The larger figure may be excessive as no complete exposures were available for accurate measurement.

Rondout Waterlime Group.

The Rondout Waterlime consists of interbedded calcareous shale, calcareous mud rock, and argillaceous limestone with an occasional sandstone. When seen in fresh exposures many of the strata seem to consist of compact, dark, purplish-blue limestone of considerable durability, but on weathering, however, the color of these strata changes to a dirty greenish hue. This same characteristic was noted by the writer in other counties of this State to the northeast, especially Pendleton, Hampshire, and Hardy, and is also reported in Maryland. This feature is due to the large amount of clay that is present in the rock. Alternating with these rocks are beds of thin-bedded, fissile, and calcareous shale that are occasionally dark-bedded. With these highly argillaceous beds are occasional strata of purer limestone. The Rondout Group as found in this area varies in thickness from 100 to 150 feet.

Bloomsburg Group.

The **Bloomsburg Group,** or the **Bloomsburg Red Shale** of White[1], is but a single sandstone member in this area and has been mapped with the Rondout Waterlime Group, being too thin to map as a separate unit. It was noted at only a few points where it consists of grayish-brown, quartzitic sandstones, varying from four to 18 inches in thickness, with an approximate total thickness of 25 feet. The Bloomsburg Group as recognized in this area retains none of the characteristic red color which is found at the type locality and

[1]I. C. White, Second Geol. Surv. of Penn., Report G7, p. 106; 1883.

also much farther southwest in northeastern West Virginia. There is little doubt, however, that the local sandstone is synonymous with at least a portion of the Bloomsburg of White, as this same member has been traced northeast across Pendleton County to southern Grant and Hardy Counties where its more typical aspects are present.

ECONOMIC ASPECTS, SALINA SERIES.

In Pocahontas County the principal economic value of the Salina Series is its use for agricultural purposes, a great deal of the limestone being suitable for burning, both for agricultural lime and Portland cement. The upper portion, or Bossardville Group, generally carries a high calcium carbonate content, the main impurity being silica or alumina which breaks down readily, so that long burning is not necessary. In the Rondout Group certain portions have been used for the manufacture of natural cement in northeastern West Virginia and western Maryland, but in Pocahontas County chemical analyses have not been made. Because of its generally inaccessible location, its value for road material in this area is overshadowed by the more readily obtainable limestone from the Greenbrier Series and the Huntersville Chert of the Oriskany Series. In this area the Bloomsburg Group is of small economic value for either road material or building stone because of vast quantities of better and more accessible material for this purpose.

NIAGARA SERIES.

GENERAL ACCOUNT, NIAGARA SERIES.

The **Niagara Series**, coming just below the Bloomsburg Sandstone of the Salina Series and slightly above the **Keefer Sandstone** of the Clinton Series, is a succession of shales with thin lenses and beds of limestone. The shales are generally buff or drab while the thin wavy-bedded or flaggy limestones vary from bluish-gray to dove-colored. This series, because of its non-resistant nature and its occurrence at high angle dips between the Keefer and Bloomsburg quartzites, is poorly exposed, so that accurate measurements were difficult to get. An interval of 50 to 100 feet will include both the minimum and maximum thicknesses of this series in Pocahontas County.

SUBDIVISIONS, NIAGARA SERIES.

The Niagara beds of New York were early subdivided by James Hall into Niagara or **Lockport Limestone** at the top, followed by the Niagara or **Rochester Shale** at the base. In the Pawpaw-Hancock Folio, Stose and Swartz describe those beds occurring between the Bloomsburg red sandstone member of the Wills Creek Shale and the Clinton Series as **McKenzie Formation,** including the Keefer Sandstone. In its Silurian volume, the Maryland Geological Survey considers the Keefer Sandstone as of Clinton age. It is, therefore, the beds that occur between the Bloomsburg Sandstone and the Keefer Sandstone that are classified as the Niagara Series in this report. In this area there is not sufficient variation in lithology from top to bottom to form the basis of any subdivision.

TOPOGRAPHIC EXPRESSION, NIAGARA SERIES.

The Niagara Series, being predominantly shaly, is much less resistant to weathering than the Bloomsburg Sandstone above or the Keefer Sandstone below, and as a result usually forms small valleys between them. It has no tendency to cliff forming and is seldom seen in good exposures save in localities where it has been uncovered in stream gullies or by artificial cuts. Its outcrop, however, usually retains flags or fragments of the limestone so that its identification is not difficult.

AREAL EXTENT, NIAGARA SERIES.

The Niagara Series with its narrow outcrop, the beds of which are usually standing at steep dips, has a very limited areal extent in Pocahontas County. Its exposures are shown on Figure 13 along with the Salina Series on page 248, and in much greater detail and on a larger scale on Map II accompanying this report. These exposures are limited to the Browns Mountain Anticlinal area, which is located east of the Greenbrier River and south of Green Bank. Along the highway (State route 43) one-half mile east of Huntersville, this series occurs but it is not a good exposure. Probably the best exposure to be found is along Rainbow Run one mile southwest of Mt. Tabor School. It can be seen again, although poorly exposed, along the highway (State route 42), on either limb of the Browns Mountain Anticline east of Dunmore; also along the county road from Frost, west, across the southern end of Michael Mountain.

CONTACTS, NIAGARA SERIES.

The upper contact of the Niagara with the Bloomsburg above has already been discussed under the same heading on the Salina Series, page 247. The lower limit of the Niagara is difficult to determine both because of the scarcity of fossils in this horizon and because there are few localities where the rocks immediately above the Keefer Sandstone are well exposed. For this reason and to facilitate areal mapping, the contact is placed at the top of the Keefer Sandstone. It is probable, however, that a few feet at least of those beds occurring above the Keefer are of Rochester age.

FOSSIL LIFE, NIAGARA SERIES.

Few collections were made from the Niagara Series. (See **Lots 12** and **25**). The identifications of these fossils along with a brief comment by Dr. John L. Tilton appear in Chapter XV, Notes on Paleontology. Marine fossils in this series are quite common, the following being particularly noted: **Favosites**, both **marylandica** and **niagarensis**, **Leptaena rhomboidalis**, gastropods, and several species of ostracods.

CORRELATION, NIAGARA SERIES.

The relationship of the Niagara Series as found in Pocahontas County to its counterparts, particularly to the northeast, in West Virginia, Maryland, and New York, has already been briefly touched upon under previous headings and especially "Subdivisions". It is not considered advisable to attempt any subdivision of this series other than to note the points of similarity with synonymous beds in other areas. In **Lot 12,** which was collected from the upper two-thirds of the Niagara beds, there occurs an assemblage of fossils, all of which are found in the McKenzie Formation of Maryland, and would seem to be synonymous with it. The same condition prevails 0.3 mile northeast of Bethel School where **Lot 25** was secured, which also includes fossils of McKenzie age as found in Maryland including **Orthoceras mckenzicus.** In view of this similarity it would seem that the Niagara Series as found in this area is essentially of the same age as the McKenzie of Maryland.

DESCRIPTION OF MEMBERS, NIAGARA SERIES.

As already stated the local Niagara appears to be confined to a single lithological unit and hence the general description of the series, as already given, embraces the description of the members.

ECONOMIC ASPECTS, NIAGARA SERIES.

From an economic standpoint the Niagara Series is of minor importance, its chief value being, when found on comparatively level land, as an agricultural soil. The shales are excellent for surfacing light-traffic roads as they contain a natural mixture of sand and clay with some lime to act as a cementing agent.

CLINTON SERIES.

GENERAL ACCOUNT, CLINTON SERIES.

The **Clinton Series,** occurring next below the Niagara, is largely of arenaceous and argillaceous character. The shales are usually a yellowish-buff or greenish to gray and have thin beds of buff-weathering sandstones. The upper limit, as defined in this report, is marked by the Keefer Sandstone, beneath which lie yellow and gray thin-bedded shales and platy sandstones with an occasional thin limestone. In most localities the presence of the **Fossil Ore Horizon** is found above the middle, which in turn was preceded by the deposition of beds predominantly shaly but containing platy sandstones with occasional thin limestones. Toward the base the sandstones increase in number and thickness and are more compact and greenish to gray in color, except the **Iron Sandstone**, which occurs in the lower portion, and which is generally more massive and red in color. Below the latter and forming the base of the Clinton, shales again predominate but in some localities are quite arenaceous, often attaining prominent sandstones. The Clinton Series, although no complete and continuous exposures are found in this area, varies from 400 to 500 feet in thickness.

SUBDIVISIONS, CLINTON SERIES.

The Clinton Series has received considerable attention from many geologists and hence there is a great deal of literature available with reference to it. The early work on these beds was done by Eaton, Hall, and others in New York State where its character is such that subdivisions as found there can not be applied with certainty in this area. In later work in Pennsylvania, the subdivisions of H. D. Rogers, as later revised by Dr. I. C. White[2], seem best adapted to the local area, except that the Keefer Sandstone that is now recognized as of Clinton age was not included. Their subdivision follows in descending stratigraphic order:

Upper Shales.
Ore Sandstone and Fossil Ore.
Middle Shales.
Iron Sandstone and Block Ore.
Lower Shales.

In a still later work, Swartz[3] has given these beds the following classification:

[2]See Second Geol. Surv. of Pa., Reports G7, pp. 111-112; 1883; and T3, p. 132; 1885.

[3]Charles K. Swartz, Silurian volume, Md. Geol. Surv., pp. 27-35; 1923.

Clinton Group.
- Rochester Formation.
  - Upper Shale and Limestone.
  - Roberts Iron Ore.
  - Keefer Sandstone Member.
- Rose Hill Formation.
  - Upper shale beds with some purplish bands.
  - Cresaptown Iron Sandstone.
  - Lower shale and sandstone beds.

It has been previously stated that in this county the Clinton is confined to those beds occurring between the top of the White Medina Sandstone and the top of the Keefer Sandstone, but at the same time recognizing the possibility of a small portion of those beds occurring immediately above the Keefer as being of Rochester or Clinton age. Since sufficient exposures are not available in this area to add much to a detailed discussion of the finer aspects of this series, the following subdivisions are followed:

Upper Shales.
Keefer Sandstone.
Shales and thin limestones.

Fossil Ore Horizon.
Middle Shales (including platy sandstone and thin limestones).

Iron Sandstone.
Lower Shales (including grayish-brown sandstone).

TOPOGRAPHIC EXPRESSION, CLINTON SERIES.

The Keefer Sandstone at or near the top of the Clinton as well as the Iron Sandstone in the lower portion are both quartzitic in character and resistant to weathering and frequently form sharp and prominent ridges. The lower shaly portion is more sandy than the Upper and Middle Shales so that the lower portion of this series forms prominent shoulders along with the underlying White Medina. The upper and middle shaly members are less resistant and form a line of weakness in the Clinton outcrop represented by a depression in the topography along either side of the Beaver Lick-Browns Mountain area.

PLATE XXXIX.—Keefer Sandstone (Quartzite), Clinton age, along State route 43, one-fourth mile southwest of Huntersville. (Photo. by Paul H. Price).

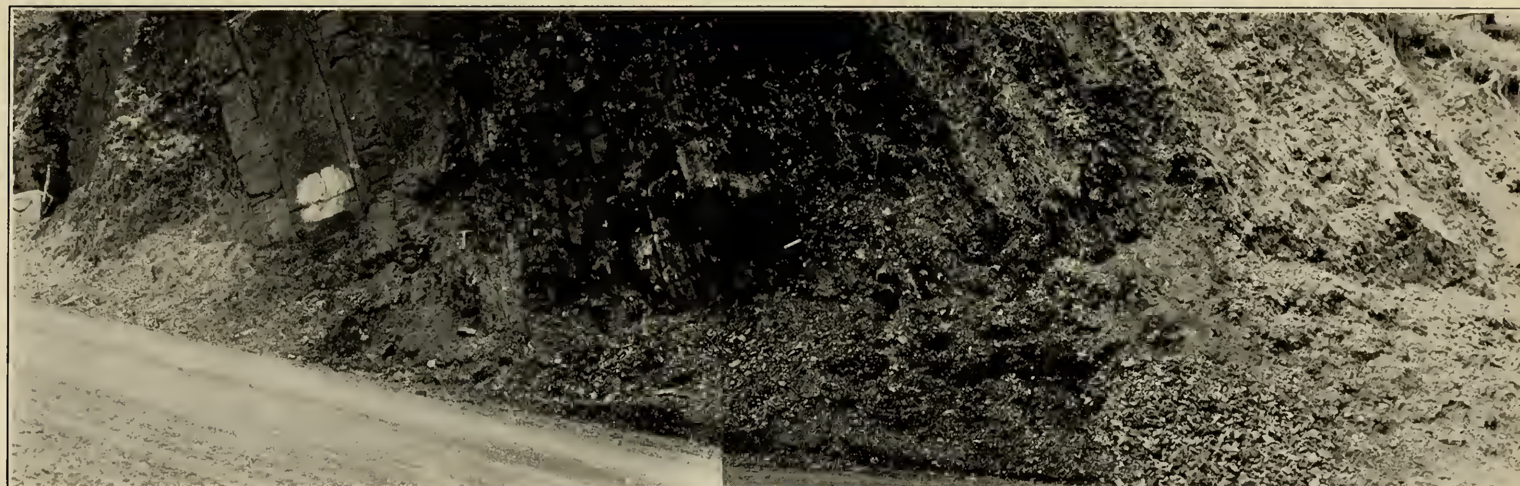

PLATE XL.—Clinton Series along State route 43, one-half mile southeast of Huntersville. Fossil Ore Horizon at left with thin beds of iron ore near hammer, grading into buff and brown shale, with thin limestone beds at right. (Photo. by Paul H. Price).

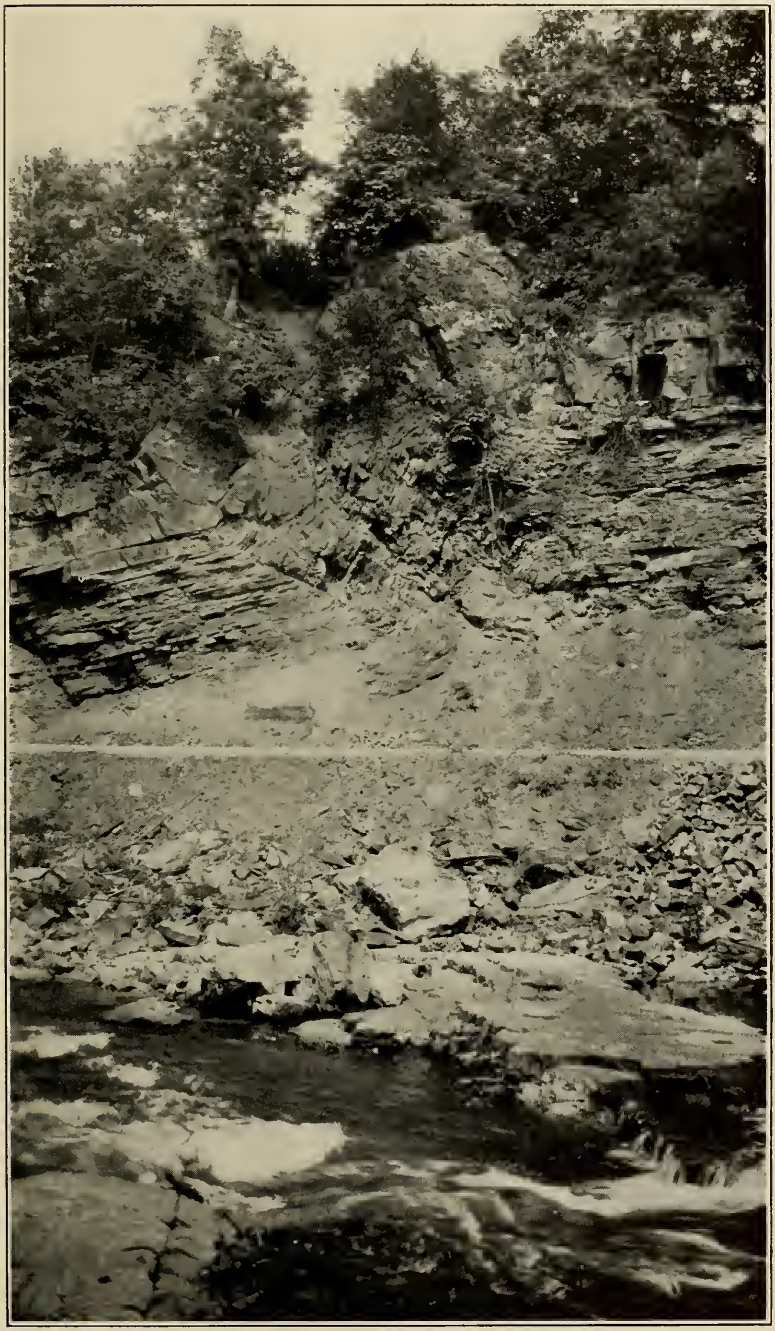

PLATE XLI.—Overthrust fault in the making. Basal Clinton squeezed to the breaking point directly over the massive White Medina Sandstone in creek bed. Along Knapp Creek one mile northwest of Minnehaha Springs. (Photo. by Paul H. Price).

PLATE XLII.—Massive Iron Sandstone (Quartzite) near base of Clinton Series 1¼ miles west of Minnehaha Springs. Note "block" weathering. (Photo. by Paul H. Price).

PLATE XLIII.—Showing effect of squeezing by lateral thrust on basal Clinton beds, with an overthrust fault in the making. Along State route 43 one mile east of Minnehaha Springs. (Photo. by Paul H. Price).

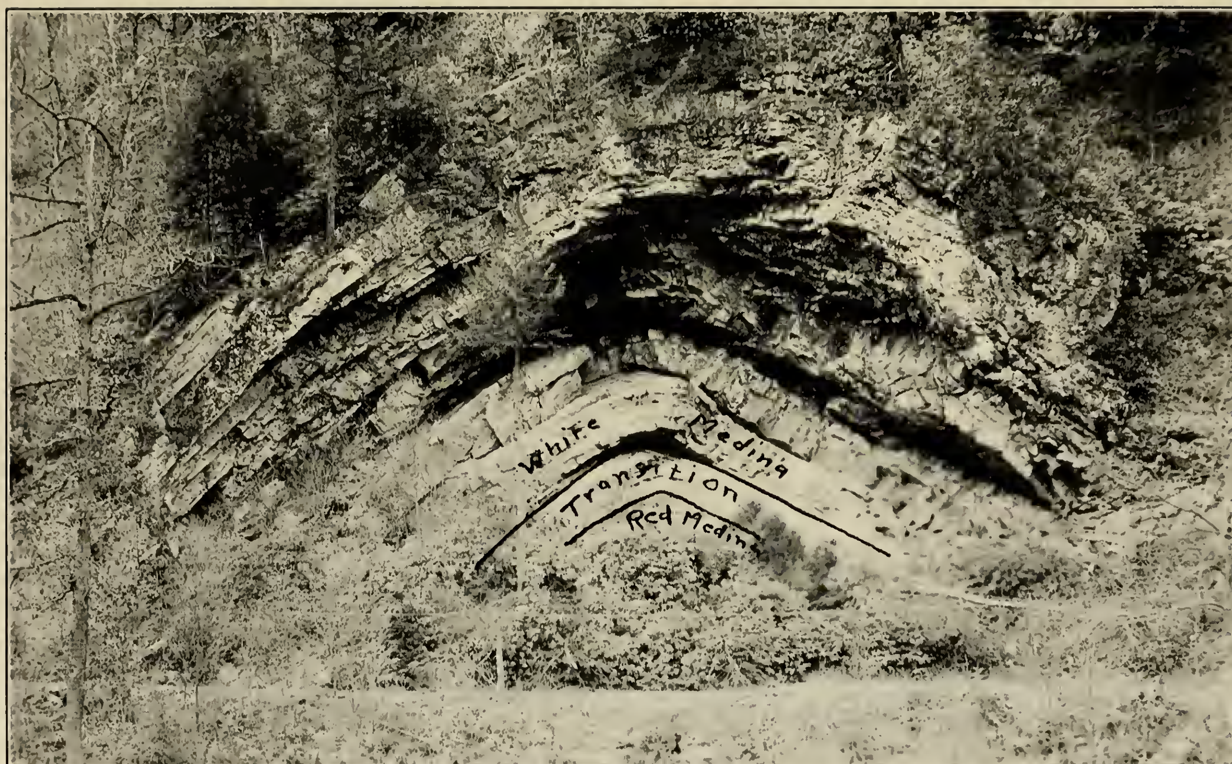

PLATE XLIV.—Beautiful arch in Medinas one mile southeast of Huntersville. Note telegraph-pole in middle foreground. Beneath this arch are a few of the remaining American yew pines in the county. (Photo. by Paul H. Price).

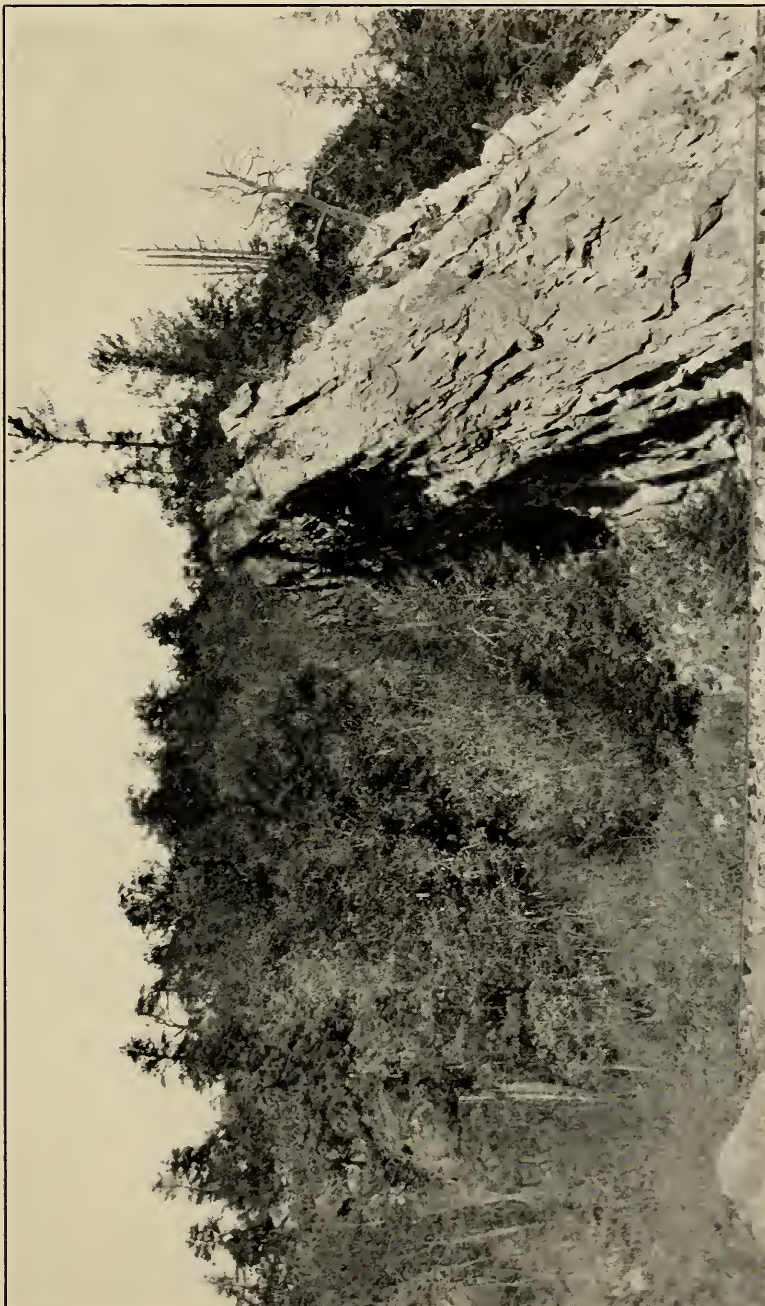

PLATE XLV.—East limb of White Medina arch plunging beneath the surface 1½ miles east of Dunmore. The west limb is to be seen faintly on extreme left. (Photo. by Paul H. Price).

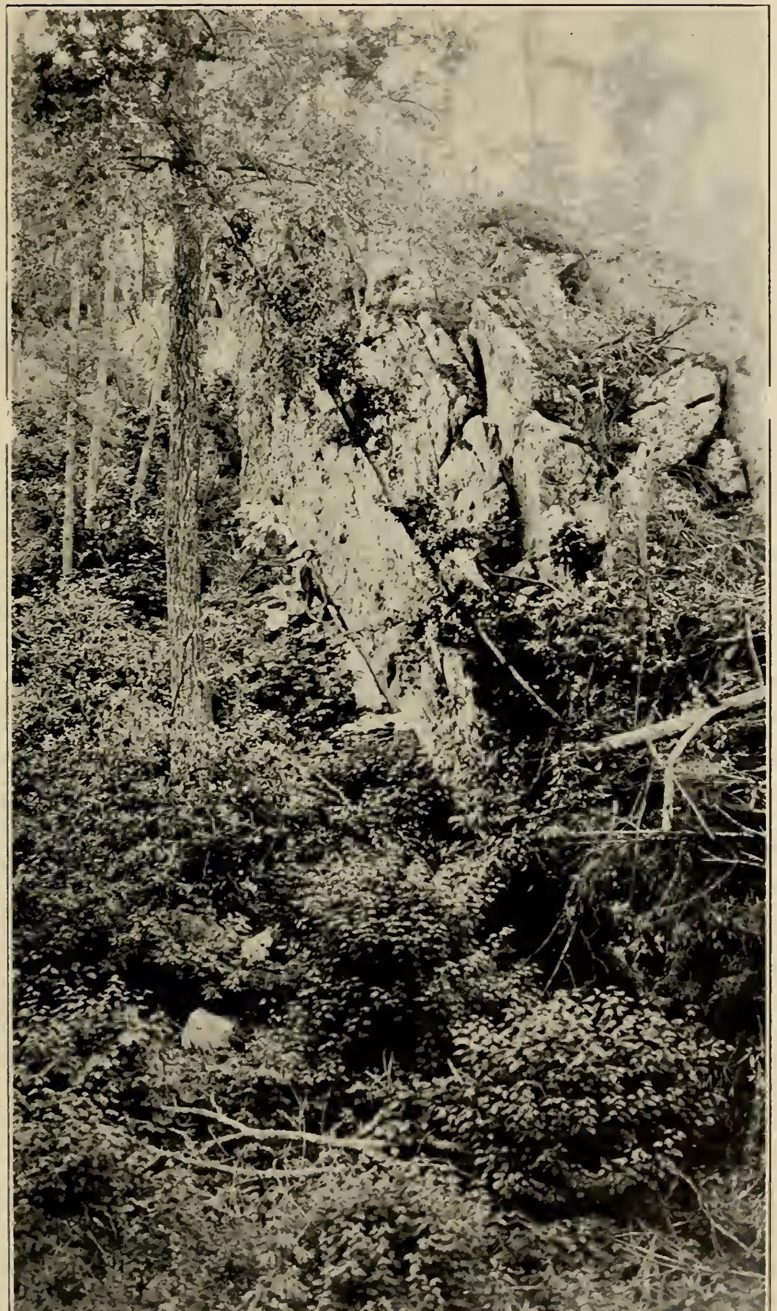

PLATE XLVI.—"Wall rock" of White Medina Sandstone, near source of Cummins Creek, 1.2 miles southeast of Cummins Creek School, on west limb of Browns Mountain Anticline. The rock is practically vertical at the base but higher up the wall arches to the east. This bed of resistant sandstone is about 50 feet thick and carries numerous **Arthrophycus alleghaniensis.** (Photo. by Paul H. Price).

AREAL EXTENT, CLINTON SERIES.

On Figure 14, prepared by the writer with drafting by George W. Grow, the outcrops of the Clinton are shown, and can be seen in greater detail and on a larger scale on Map II accompanying this report. The exposures of the Clinton are confined to the Beaver Lick-Browns-Michael Mountain area in the southeastern portion of the county. What is probably the best and most accessible exposure is that about one-half mile southeast of Huntersville along the highway (State route 43). A record of this outcrop appears in the Knapp Creek Section, page 107. A similar exposure can be seen along the highway (State route 42) on the east side of the Browns Mountain Anticline just east of the Minnehaha Springs bridge across Knapp Creek. Another exposure is found along Rainbow Run on the western limb of the Browns Mountain Anticline. Several isolated outcrops of this series occur in the folds of Beaver Lick and Browns Mountains but are all poorly exposed. The highway (State route 42) southeast of Dunmore cuts across the northern end of the Browns Mountain Anticline, but an accumulation of talus practically conceals these outcrops.

CONTACTS, CLINTON SERIES.

The upper contact of the Clinton Series with the overlying Niagara has already been discussed under the latter series on page 253. Attention was called to the fact that in mapping the contact was placed at the top of the Keefer Sandstone and also to the possibility of a few feet of the overlying shales being of Rochester or Clinton age. The lower contact with the White Medina appears, in places, to be transitional, while at others evidence of erosional unconformity is noticeable. In the local area the contact is placed above the grayish-brown to white, quartzitic sandstones that are devoid of any organic remains other than fucoids and **Arthrophycus alleghaniensis.** The nature of this contact is best shown along the Knapp Creek gorge, 0.7 mile southeast of Huntersville, as shown in the Knapp Creek Section, page 107. Along the same stream one mile farther southeast, the following section was measured:

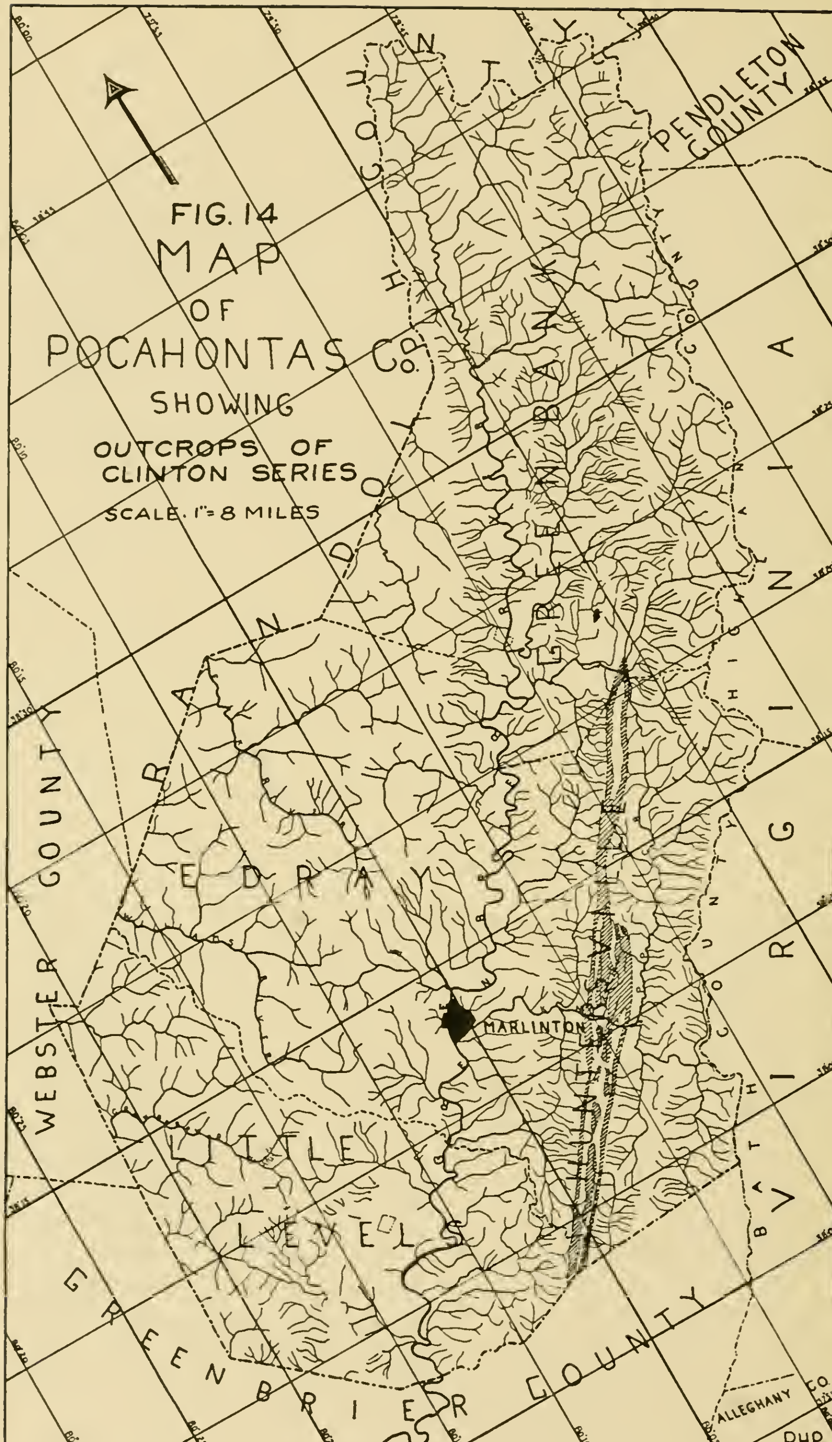
FIG. 14
MAP
OF
POCAHONTAS Co.
SHOWING
OUTCROPS OF
CLINTON SERIES
SCALE. 1"=8 MILES
RANDOLPH COUNTY
PENDLETON COUNTY
HIGHLAND COUNTY
VIRGINIA
WEBSTER COUNTY
GREENBRIER COUNTY
BATH COUNTY
ALLEGHANY CO.
EDRAY
LITTLE LEVELS
MARLINTON
PHP.

	Thickness. Feet.	Total. Feet.
Sandstone, **Iron Sandstone**, red, ferruginous, massive, but weathering in blocks	25	25
Shale, brown, alternating with grayish-brown sandstone and thin beds of dark shale	20	45
White Medina Series		
Sandstone, gray to white, quartzitic	2	47
Shales, variegated, and sandstone, quartzitic	5	52
Sandstone, white, quartzitic; breaks into blocks	10	62
Sandstone, dark, shaly	1	63
Sandstone, white, quartzitic, massive	5	68
Shales, dark, alternating with flaggy, quartzitic sandstones	10	78
Concealed		

FOSSIL LIFE, CLINTON SERIES.

The Clinton Series was found to be sparingly fossiliferous in this area, but marine fossils were noted as being present. Unfortunately no collection was made from this series.

CORRELATION, CLINTON SERIES.

Under the heading "Subdivisions", attention has already been called to certain relationships of the Clinton Series as found in Pocahontas County to those of its more northeastern counterparts in Maryland, Pennsylvania, and New York. The **Keefer Sandstone** of Stose and Swartz[1] was named from its occurrence in northeastern West Virginia and has now been traced southwestward across the State. Farther down in the series a thin bed of iron ore occurs, along with shaly and siliceous, fossiliferous limestones, that correlates with the Fossil Ore Horizon of eastern Pennsylvania. In the basal portion of the Clinton in this area there is a prominent red sandstone which attains a thickness of as much as 50 feet. It weathers into rectangular blocks and makes a heavy talus of an iron—rich or lean "iron ore". (Samples were taken from this horizon for analysis, the results of which follow in Chapter XIV under Iron Ore). There is little doubt that this sandstone correlates with the **Iron Sandstone and Block Ore** of Rogers and White, which in turn is synonymous

[1]G. W. Stose and C. K. Swartz, Pawpaw-Hancock Folio, No. 179, U. S. Geol. Surv.; 1912.

with the **Cresaptown Iron Sandstone** of the Maryland Geological Survey. It has also been included with the **Cacapon** by Darton in the Monterey Folio.

DESCRIPTION OF MEMBERS, CLINTON SERIES.

Upper Shales.

The shales coming above the Keefer and referred to as the **Upper Shales** do not appear to be generally present in Pocahontas County. At most points where the Keefer is exposed the immediately overlying interval is concealed so that their presence can not be definitely proved.

Keefer Sandstone.

The **Keefer Sandstone** was first named by Stose and Swartz[5] from its occurrence in Keefer Mountain, a few miles northeast of Hancock, where it forms a thick and massive bed. In Pocahontas County this same member is present, being composed of grayish-brown sandstones that vary from four to eight feet in thickness, often quartzitic in character, and having a total thickness of 15 to 25 feet. This member was noted at several points in the county and can be seen along the highway, one-half mile southeast of Huntersville, dipping 53° northwest; along Irvin Hollow, 0.8 mile northwest of Westminster Church, dipping 50° southeast; along a second-class road 0.3 mile northeast of Bethel School, dipping 20° northwest; in a sharp anticline on the southern end of Michael Mountain, 1½ miles southwest of Cove Hill School.

Shales and Thin Limestones.

Between the Keefer Sandstone and the Fossil Iron Ore Horizon there occurs a succession of yellowish-gray to olive, thin shales and platy sandstones with occasional limestones one to six inches in thickness. (See Plate XL).

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[5]Ibid.

Fossil Ore Horizon.

The **Fossil Ore Horizon** was noted at only one locality, its position being shown in the Knapp Creek Section, page 107. Here the ore itself is limited to a seven-inch seam, being red, soft, and somewhat ocherous, and having the appearance of a leached limestone. It is associated with a very siliceous limestone or what might better be called a calcareous sandstone. (See Plate XL). Fossils were not observed in the ore itself but were closely associated in the superjacent and subjacent beds.

Middle Shales.

The **Middle Shales** occupy the interval between the Fossil Ore Horizon and the Iron Sandstone. These shales vary in color from yellow and olive to green, red, or dark, and attain a thickness of approximately 250 feet. Occasionally calcareous lenses and streaks occur along with thin sandstones.

Iron Sandstone.

The **Iron Sandstone** in this area is one of the most prominent members of the Clinton Series. It has a deep-red color and consists of quartz grains cemented with hematite. It is often oolitic in texture. The more ferruginous beds resemble a low-grade iron ore but the proportion of silica is entirely too high to permit their use as a source for commercial iron at the present time. (See sample numbers 24 and 33, Chapter XIII). It is frequently blocky and very resistant to weathering so that it is admirably adapted for building purposes. This sandstone is limited to the Beaver Lick-Browns-Michael Mountain area and can be seen in good exposures at the following points: near the head of Beaver Creek on the west side of Beaver Lick Mountain two miles (air-line) northeast of Burr School, where it attains a thickness of 50 to 75 feet; along the highway (State route 43) where a series of folds (See Figure 17) has brought the Iron Sandstone to the surface at several points that vary from 25 to 50 feet in thickness; along Rainbow Run on either side of the White Medina arch one mile southwest of Mt. Tabor School; along the southern end of Michael Mountain one mile west of Thorny Creek School; along the highway on either side of the White Medina arch 1.8 miles southeast of Dunmore.

Lower Shales.

The **Lower Shales** consist of brownish-gray or dark, fissile shales, intercalated with flaggy sandstone, and vary in thickness from 20 to 60 feet. The shales are best exposed along the Knapp Creek gorge between Huntersville and Minnehaha Springs. (See Plates XLI and XLIII).

ECONOMIC ASPECTS, CLINTON SERIES.

At certain points in Pocahontas County the Clinton Series contains local deposits of iron ore that are of good enough quality to encourage more thorough prospecting. At no point in fresh exposures was there found ore of minable thickness in the Fossil Ore Horizon, and the Iron Sandstone is too low in ore to be used for this purpose. At some points, however, where the rocks are so folded as to form troughs or basins, there will probably be found better grade ores due to local enrichment from leaching of the higher beds. This will require further prospecting at such points. In the area of Michael Mountain loose pieces of manganese were found on the slopes that carry this ore in what would appear to be paying quantities. A further discussion of these ores will appear under their respective headings in Chapter XIII.

Many of the Clinton sandstones are of sufficient hardness to be used as a building stone. The Iron Sandstone breaks into rectangular blocks and is of a pleasing red color so that it is admirably adapted for that purpose.

WHITE MEDINA SERIES.

GENERAL ACCOUNT, WHITE MEDINA SERIES.

The **White Medina Series**, coming just below the Clinton

Series and at the top of the three Medinas as recognized in West Virginia, is present in Pocahontas County, being a prominent white quartzite and varying in thickness from 50 to 188 feet. In this area it contains intercalations of brown and dark, fissile and sandy shales in the upper part. Its greater portion is thick-bedded and carries a siliceous cement so that it is very resistant to weathering and makes prominent ridges. It often contains rounded white quartz pebbles. It is exposed to good advantage along the Knapp Creek gorge between Huntersville and Minnehaha Springs. (See Figure 17 and Plates XLIV, XLV, and XLVI). It also forms the backbone of Beaver Lick and Michael Mountains. It is upon exposures of this sandstone that the fire-towers are located on Beaver Lick Mountain at White Rocks and at the "Lookout" fire-tower on Michael Mountain.

SUBDIVISIONS, WHITE MEDINA SERIES.

So far as known little or no attempt has been made to subdivide the White Medina. In general, it is a single lithologic unit, containing in this area no marine life other than **Arthrophycus** and fucoids. In Pocahontas County the upper portion contains several thin beds of shale which might afford sufficient evidence for a subdivision.

TOPOGRAPHIC EXPRESSION, WHITE MEDINA SERIES.

The White Medina, on account of its quartzitic character and massive bedding, is the most resistant to weathering of any rock exposed in the county. Its exposures are always marked by a rugged topography. In the area of its outcrop it is the chief ridge-forming rock and great blocks of the sandstone, which frequently forms the crests of the mountains, break away from the ledge and work by gravity down the steep slopes and frequently conceal the underlying formations.

AREAL EXTENT, WHITE MEDINA SERIES.

On Figure 15, prepared by the writer with drafting by George W. Grow, the outcrop of the White Medina can be seen at a glance, while on Map II these same exposures are shown in greater detail and on a larger scale. These exposures are limited to the Browns Mountain Anticlinal area, being confined to Beaver Lick, Brushy, Browns, and Michael Mountains. Excellent exposures for study are available in the Knapp Creek gorge between Huntersville and Minnehaha Springs where the White Medina occurs in numerous folds. (See Figure 17; also Plates XLIV and XLVI). It is also exposed in a sharp arch along the highway 1.7 miles southeast of Dunmore. (See Plate XLV). Along the crest of Michael Mountain this sandstone stands at very high angles, the same being true along the crests of Beaver Lick and Brushy Mountains.

CONTACTS, WHITE MEDINA SERIES.

The upper contact of the White Medina has already been discussed in the description of the Clinton Series. Its base rests upon the red shales and red sandstones of the Red Medina Series. The contact, however, is not so pronounced as would generally be expected between beds so vastly different. The change from red to white is transitional as is well shown in the beautiful arch along the highway 0.8 mile southeast of Huntersville where the following section was measured:

		Thickness. Ft.	In.	Total. Ft.	In.
White Medina Series (lower 13′ 2″)					
Quartzite; few pebbles	1′ 2″				
Quartzite; abundant pebbles	4 0				
Quartzite; massive, pebbles sparse, except at base where there is a 3″ iron sandstone conglomerate	8 0	13	2	13	2
Transition beds (17′ 10″)					
Sandstone, light-gray, argillaceous	2′ 6″				
Sandstone, greenish-brown, alternating with sandy shales	5 0				
Quartzite, reddish-brown	4 0	17	10	31	0
Sandstone, light, shaly	1 8				
Shales, brown, gray, sandy, with 1′ of sandstone	4 8				
Shales, red, and sandstones, red					

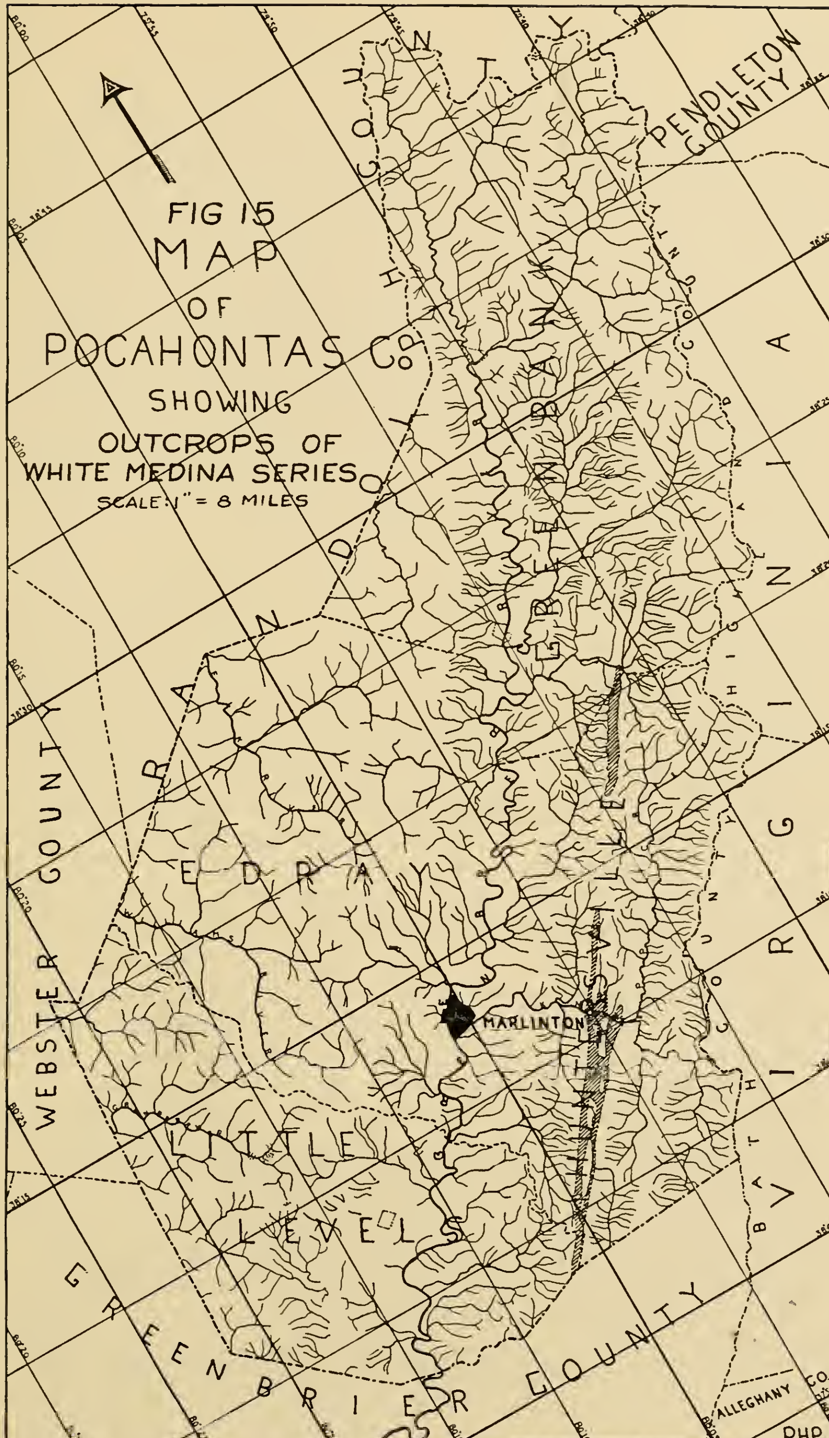
FIG 15
MAP
OF
POCAHONTAS Co.
SHOWING
OUTCROPS OF
WHITE MEDINA SERIES
SCALE: 1" = 8 MILES
RANDOLPH COUNTY
PENDLETON COUNTY
HIGHLAND COUNTY
VIRGINIA
WEBSTER COUNTY
GREENBRIER COUNTY
BATH COUNTY
ALLEGHANY CO.
EDRAY
LITTLE LEVELS
MARLINTON
GREENBANK
HUNTERSVILLE
PHP

From the above section it can be seen that the contact is not an abrupt one, there being a gradual transition from the typical red shales into the true White Medina.

FOSSIL LIFE, WHITE MEDINA SERIES.

The White Medina in Pocahontas County, as in other localities, is sparingly fossiliferous. The most abundant species is **Arthrophycus alleghaniensis,** a trail resembling a seaweed, which is often found covering the under-side of these beds with its numerous interlacing "stems". Straight tubular borings occasionally refilled and standing at right angles to the bedding are found and are believed to be the same as similar borings found in the Medina of New York and named **Scolithus verticalis** by Hall. This is one of the most characteristic fossils of the White Medina, being widely distributed at this horizon throughout the Appalachian area. In the shale parting of the upper portion of these beds there occurs an abundance of small stem-like, rounded and semi-rounded forms, that are both single and branching. The surface is smooth and without markings but does not retain a uniform width as in **Arthrophycus alleghaniensis.** These forms, while probably of organic origin, are only classed in general as fucoids.

CORRELATION, WHITE MEDINA SERIES.

The White Medina as recognized in West Virginia and where it has been traced entirely across the State, following the Appalachian counties as it does, has been described under different names in other localities. That it corresponds to the White Medina of the New York and Pennsylvania Surveys appears to be without doubt. The name **Albion** was given it in New York by Kindle[6]. In various Folios of the U. S. Geological Survey it is called **Tuscarora,** named from its outcrop in Tuscarora Mountains in Pennsylvania. In the adjoining State of Virginia and other southern Appalachian States it correlates with the **Clinch.**

[6]E. M. Kindle and F. B. Taylor, U. S. Geol. Survey, Niagara Folio, No. 190; 1913.

ECONOMIC ASPECTS, WHITE MEDINA SERIES.

The White Medina, while very hard and resistant, has not been used as a building stone because it can not be satisfactorily split into blocks. It has been used, particularly in adjoining counties of Virginia, as a base for hard-surfaced roads. It contains a high percentage of silica but its use as a glass-sand has not proved satisfactory because of its conglomeratic character. The white quartzitic members are suited for ganister and should be suitable for various traprock uses.

RED MEDINA SERIES.

GENERAL ACCOUNT, RED MEDINA SERIES.

The Red Medina Series, marking the oldest rocks exposed in the area of this report, is composed of red sandstone and red shale of approximately equal amounts. The sandstones vary in thickness from flags a few inches thick to ledges of as many feet alternating with the shale in like proportions. Along with the shale is an occasional thin layer of bluish-green shale that breaks the monotony of the reds. The sandstones at their best exposures in this locality are hard and somewhat quartzitic and break into rectangular blocks presenting jagged edges.

The Red Medina Series is exposed in only a few localities in the county and these are limited to the Beaver Lick-Brushy-Browns Mountain area with three of the exposures occurring along the Knapp Creek gorge where the creek has cut directly across this mountain revealing the lower rocks. The few remaining exposures are limited to the western side of this uplift where lateral drainage has cut wedge-shaped valleys through the overlying White Medina, revealing the upper portion of the reds. At none of these exposures is the entire thickness to be seen. The greatest, however, is along Knapp Creek just west of the Minnehaha Springs bridge, where a thickness of some 600 feet was measured, which in the writer's opinion must be near its entirety.

SUBDIVISIONS, RED MEDINA SERIES.

So far as known little or no attempt to subdivide the Red Medina has been made, even in regions where the formation attains a much greater thickness. Neither the sandstone nor the shales have any particular characteristics to differentiate them, and they are often lenticular and without organic remains, so that it has been necessary to treat the entire series as a single formation.

TOPOGRAPHIC EXPRESSION, RED MEDINA SERIES.

In every locality in Pocahontas County where the Red Medina outcrops, it lies immediately beneath an imposing escarpment of the resistant White Medina Sandstone and weathers to a rather smooth steep slope that is largely covered by talus from the White Medina. Hence exposures of this formation in the county are not sufficient, either in number or extent, to reveal a characteristic topographic expression, but in adjoining counties to the northeast rather steep but somewhat rounded slopes are the result. Plates XLIV and XLVII afford views of this formation.

AREAL EXTENT, RED MEDINA SERIES.

As noted in preceding paragraphs the areal extent of the Red Medina in Pocahontas County is quite limited. The best and only exposures suitable for study are to be seen along the Knapp Creek gorge between Huntersville and Minnehaha Springs. Here a series of folds has brought this formation above drainage at three successive intervals where the beds are now exposed in fresh cuts by the roadside. (See Figure 17). The remaining exposures are unimportant and are limited to the west side of Beaver Lick and Browns Mountains. Along Rainbow Run near the head of Browns Creek, a portion of the west limb of a small arch can be seen while the greater part of the arch is covered with the overlying White Medina talus. South of the Knapp Creek gorge three small exposures are to be seen where small lateral branches have cut deep passes into the same uplift.

On Figure 16, prepared by the writer with drafting by George W. Grow, the distribution of the Red Medina Series may be seen at a glance, being limited to the Browns Mountain Anticlinal in Huntersville District. On Map II, accompanying this report, these same exposures are shown in much greater detail and on a larger scale.

CONTACTS, RED MEDINA SERIES.

The upper boundary of the Red Medina with the White Medina has already been discussed in the description of the latter formation, attention being called to the gradual change from one to the other at its best exposures along the Knapp Creek gorge, but at the same time recognizing the marked contrast between the two respective series. As the lower limits of the Red Medina do not get above drainage in this area and as there has been no drilling below this horizon in Pocahontas County, its lower contact can not be discussed.

FOSSIL LIFE, RED MEDINA SERIES.

The Red Medina Series has been quite generally considered non-fossiliferous. This same condition prevails in Pocahontas County but at one point in particular in the upper part of the series some rounded, curved, and branching forms were collected on account of their organic appearance. Dr. Tilton in Chapter XV judges these forms to be evidence of algae.

CORRELATION, RED MEDINA SERIES.

The Red Medina of Pocahontas County appears to be the same as the **Juniata** of various Folios of the U. S. Geological Survey, and the same as the **Bays Sandstone** of Folio No. 26.

In Figure 17, prepared by the writer, is shown a cross-section involving the intensely folded Medina and Clinton Series across the Browns Mountain Anticlinal area between the Huntersville and Minnehaha Springs bridges. This sec-

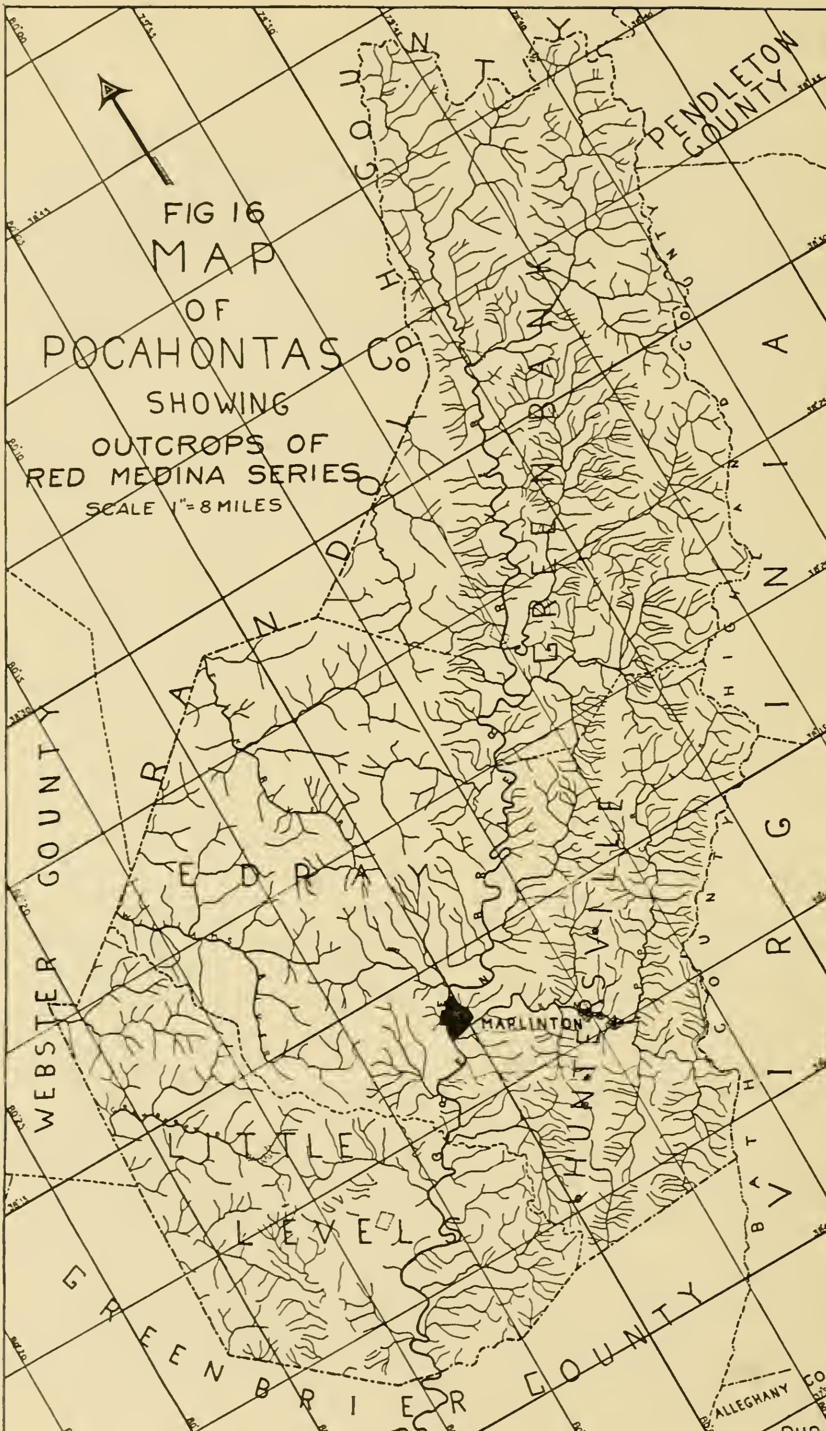
FIG 16
MAP
OF
POCAHONTAS Co.
SHOWING
OUTCROPS OF
RED MEDINA SERIES
SCALE 1" = 8 MILES
PENDLETON COUNTY
RANDOLPH COUNTY
WEBSTER COUNTY
GREENBRIER COUNTY
VIRGINIA
HIGHLAND COUNTY
BATH COUNTY
ALLEGHANY CO.
MARLINTON
HUNTERSVILLE
EDRAY
LITTLE LEVELS
GREENBRIER R.
PHP

tion, in general, is typical of this structural feature because it has much minor folding which involves the competent sandstone layers as well as the less competent shales.

ECONOMIC ASPECTS, RED MEDINA SERIES.

From an economic standpoint, the Red Medina Series in this area is of minor importance, the shales being generally too sandy for brick or tile manufacture, while the sandstones are generally too lenticular or too shaly for building stone. Occasionally, however, along the Knapp Creek gorge between Huntersville and Minnehaha Springs, the sandstones do attain a character suitable for this purpose.

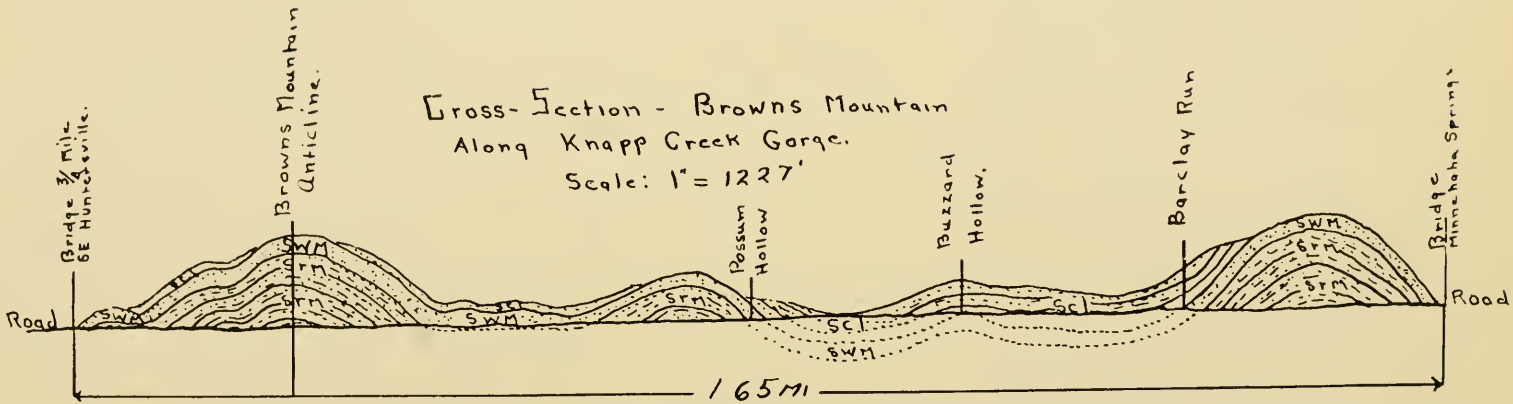

Figure 17.—Cross-section of the Browns Mountain Anticlinal Area along the highway (State route 43) following the Knapp Creek gorge between the Huntersville bridge, 0.8 mile southeast of Huntersville, and the Minnehaha Springs bridge, 0.5 mile northwest of Minnehaha Springs.

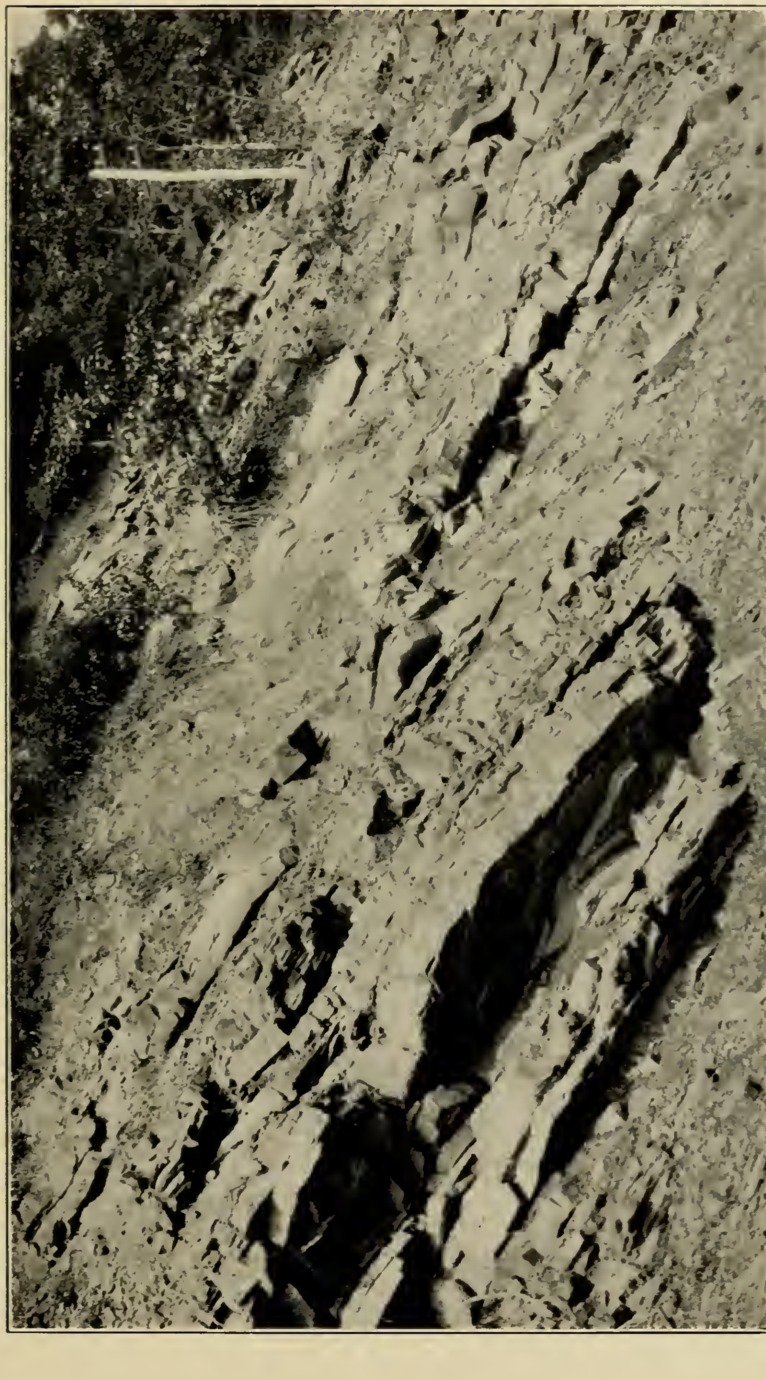

PLATE XLVII.—Red Medina Series. Red sandstones alternating with red shales. Along Knapp Creek road one-tenth mile northwest of Minnehaha Springs bridge. (Photo. by Paul H. Price).

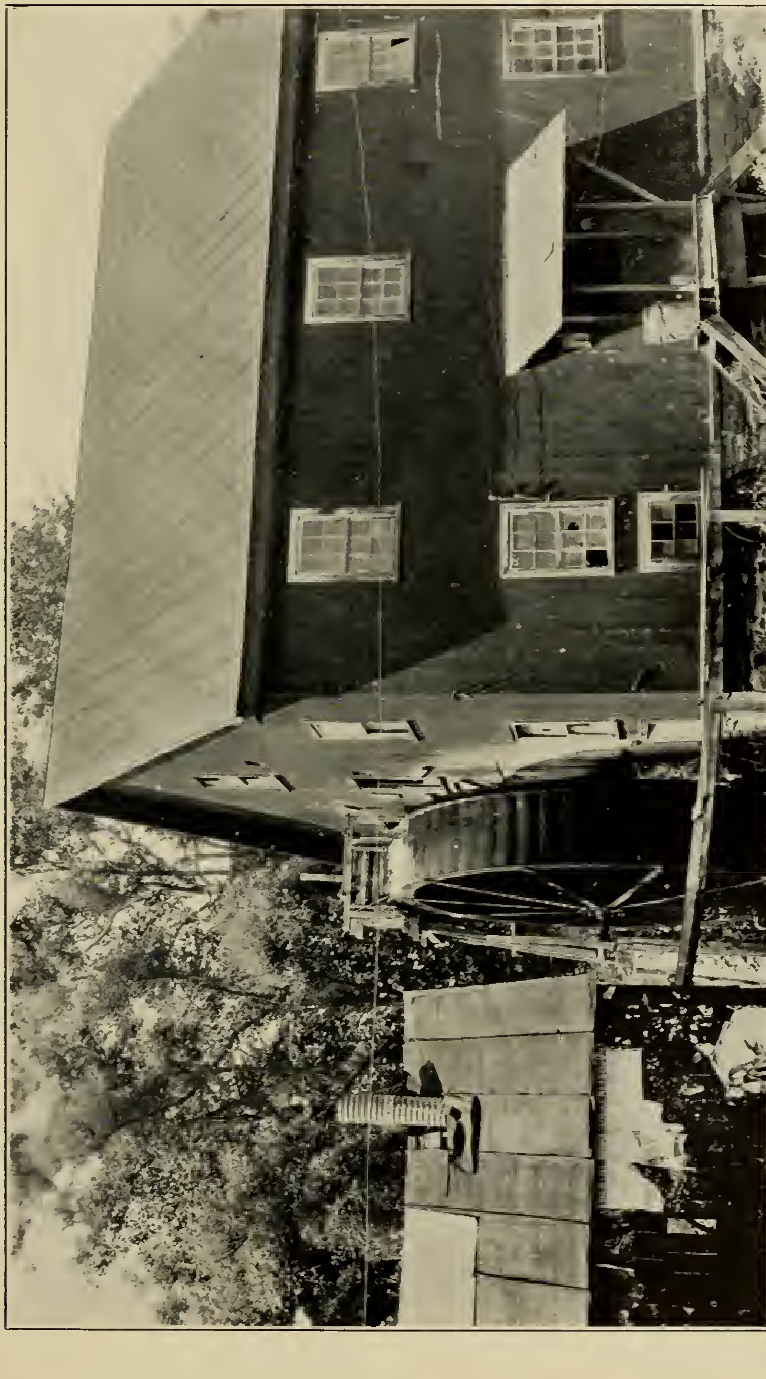

PLATE XLVIII.—Flour and feed mill of H. W. McNeel at Mill Point. Power furnished by water from Stamping Creek, except in dry summer months when steam is used. (Photo. by Paul H. Price).

PLATE IL.—Oak tree on Stamping Creek near Mill Point under which General R. E. Lee camped. (Photo. by Paul H. Price).

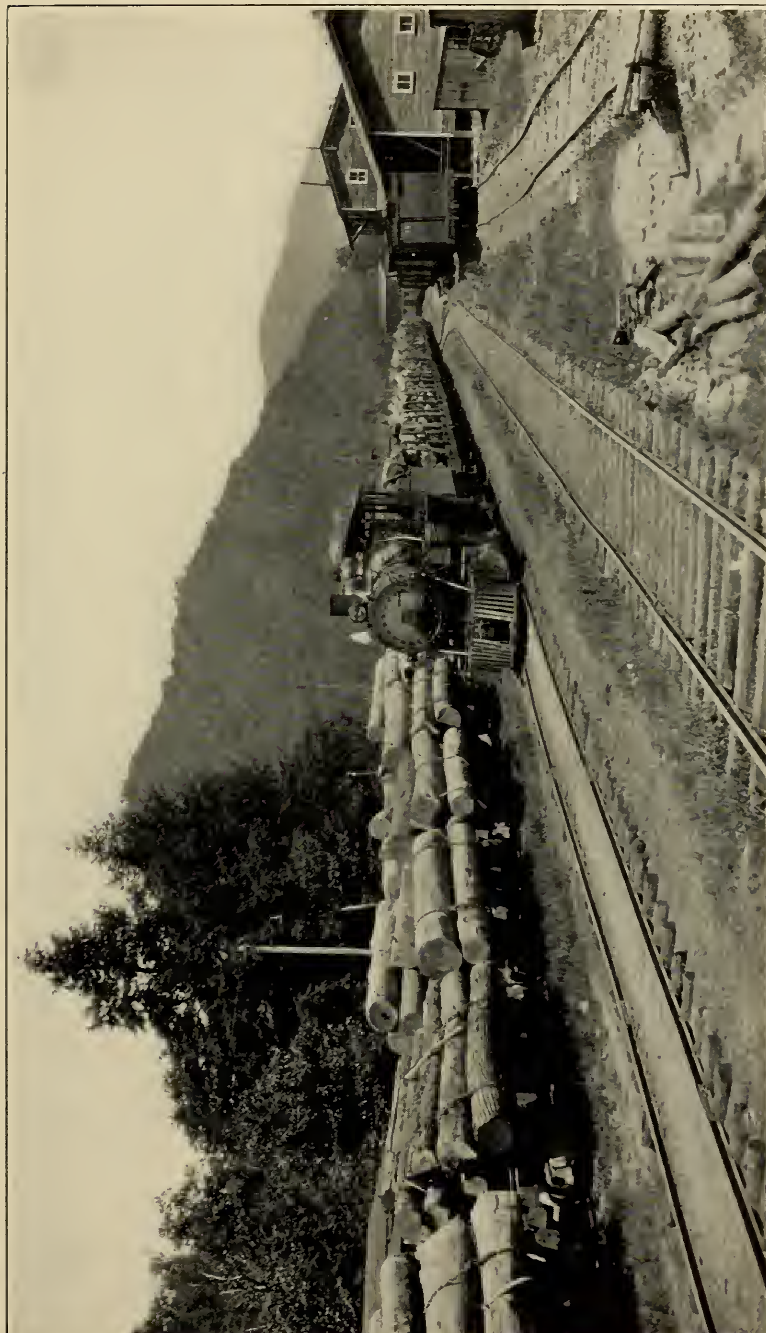

PLATE L.—Logs at Three Forks of Williams River. Cut in western Pocahontas County by the Cherry River Boom and Lumber Company. (Photo. by Paul H. Price).

PART III.

Mineral Resources.

CHAPTER XII.

PETROLEUM, NATURAL GAS, AND COMMERCIAL COAL.

PETROLEUM AND NATURAL GAS.

GENERAL STATEMENT.

In the discussion of the oil and gas possibilities of any area, certain general conditions or factors should be considered. These in their relative importance are as follows: presence of oil and gas horizons, structural conditions favorable for the retention of these hydrocarbons. Under the first heading the area under consideration comes within the possible class as evidenced by the geological column as shown in Figure 4, pages 71-73. Under the second heading the favorable factors are much less certain.

Throughout the producing areas of the eastern United States the controlling factor in oil and gas accumulation is the Appalachian Geosyncline. This structural feature enters West Virginia on the north near the southwestern corner of Pennsylvania and passes southwestward across the State in a direction generally parallel to the folded area of the Appalachian Mountains, and passes into Kentucky a few miles south of Kenova, Wayne County. Within the limits of this structural depression, covered largely by rocks of Permo-Carboniferous age, there are numerous accumulations of both oil and gas in the minor folds, but in passing southeastward toward the folded mountain areas these pools become more scattered and smaller in size until finally their presence in commercial quantities is no longer found. In general the gas accumulations are found approximately 15 miles farther southeastward than the last oil pools.

Pocahontas County is situated southeast of the main proved oil and gas belt of the State. Its western limit is approximately 35 and 45 miles southeast of the best producing fields of Braxton and Clay Counties, respectively, west of which the occurrence of oil and gas is known to be quite general along the minor anticlines and synclines. Subsequent drilling has proved the presence of gas in western and northern Nicholas (25 miles distant) and northwestern Fayette Counties (45 miles westward). Southeast of these localities various tests drilled in the intervening territory have shown only slight amounts of oil and gas or have been totally dry. In Webster County, lying west of Pocahontas, six deep wells have been drilled, four of which reported shows of gas and two of which were recorded as dry holes.

In Pocahontas County one deep hole and a few shallower wells have been drilled. The results of these wells have been generally unfavorable, there being reported a show of oil in the deep well with traces of gas in the shallower wells.

As a prospective oil or gas region that portion of the county lying east of the Greenbrier River may be fairly accurately eliminated from consideration because of the fact that most of the known oil and gas horizons of the Appalachian region belong above the topography or outcrop at the surface in such broken and disturbed conditions that whatever oil and gas they may have once held have, in all probability, escaped either by evaporation or actual flowage down the streams of the region. The presence of a petroleum residue now found beneath the flood-plain terrace, upon which the town of Marlinton is situated, is evidence that the latter condition actually existed.

In that area west of the Greenbrier River, however, conditions are somewhat different. Here the youngest rocks are those of the Pennsylvanian, followed in descending stratigraphic order by the Mississippian, Devonian, Silurian, and Ordovician rocks, the shales and limestones of which are known to contain sufficient vegetable and animal remains for the distillation of oil and gas. Furthermore the folding is less severe with some structure favorable for the retention of liquid hydrocarbons in pools.

In other fundamental conditions, however, this region is less favorable. The Pennsylvanian beds occupy only the tops of the mountains in the plateau region, with their sands exposed to the air. The Mauch Chunk Series of the Mississippian has been greatly dissected by the major streams and is above drainage throughout a large part of this area.

A further and what appears to be a vital factor is that the heat and pressure that accompanied the folding, which formed the various ridges of the Alleghenies, was so intense as to produce incipient metamorphism, that may have completely volatilized the hydrocarbons, and may have permitted their escape in gaseous form. Dr. David White of the United States Geological Survey has established the point that oil is seldom found in regions where the coals have extremely low volatile and high carbon content, and that gas in such localities is less abundant than in areas where the relative percentage of carbon is smaller, the explanation being that a coal analysis reveals the extent of metamorphism and affords a criterion by which the same process in the petroleum hydrocarbons may be roughly measured. A carbon ratio for any point, at which a coal sample can be secured, may be obtained by dividing the fixed carbon of the proximate analysis by the sum of the fixed carbon and the volatile matter of the same analysis on a moisture-free basis. Therefore if a number of carbon ratios can be obtained, isocarbs, or lines of equal carbon, may be established so that lines of average equal content may be drawn that will show the approximate ratio for any position. It has been proved rather conclusively that oil is found principally in the regions where the isocarbs indicate a ratio of less than 60, but occasionally between 60 and 65, and that gas in commercial quantities is seldom found where the ratio is above 70.

In Pocahontas County the average carbon ratio of three samples of Sewell Coal in the western side of the county is 73. In three samples taken from the Hughes Ferry Coal the average carbon ratio is 66, while one sample taken from the Merrimac or "Big Seam" Coal of the Pocono is 85. An average of all samples gives a ratio of 71. These high averages make the occurrence of oil quite improbable and indicate that the search for gas in paying quantities will be a hazardous undertaking.

OIL AND GAS HORIZONS.

The following classification of the various oil and gas horizons of the State, taken from a former report of the Survey[1], shows the productive horizons of other counties, including some which have produced oil in northwestern Pennsylvania but which may not have yielded commercial quantities in West Virginia. It also shows the deeper horizons of Ohio and Kentucky, some of which are now being sought for in various parts of the State. In this table the sands are grouped under formations, the titles in use by the drillers being given preference, followed in many cases by their geologic equivalents:

Oil and Gas Horizons of West Virginia.

Pennsylvanian:	
Monongahela Series	Carroll Sand (Uniontown).
Conemaugh Series	Minshall Sand (Connellsville). Murphy Sand (Morgantown). Moundsville Sand (Saltsburg). First Cow Run (Little Dunkard) Sand (Buffalo). Big Dunkard Sand (Mahoning).
Allegheny Series	Burning Springs Sand (Upper Freeport). Gas Sand of Marion and Monongalia Counties (Lower Freeport).

[1]David B. Reger, Mercer, Monroe, and Summers Rept., W. Va. Geol. Sur., pp. 649-50; 1926.

Pottsville Series..............	Second Cow Run Sand of Ohio (Homewood). Cairo Gas Sand. Cairo Salt Sand. Cairo? Rosedale Gas Sand (Guyandot). Rosedale Salt Sand (Sharon Conglomerate). Breeden Sand (new) of Mingo County.
Mississippian:	
Mauch Chunk Red Shale Series	Princeton Conglomerate Maxton (Droop?), Dawson. Little Lime.
Greenbrier Limestone Series..	Big Lime.
Pocono Sandstone Series......	Keener Sand and Beckett Sand of Milton. Big Injun Sand (Logan). Squaw Sand. Weir Sand (Broad Ford). Berea Sand.
Devonian:	
Catskill Red Beds............	Gantz Sand. Fifty-foot Sand. Thirty-foot Sand. Gordon Stray Sand. Gordon Sand. Fourth Sand. McDonald or Fifth Sand. Bayard or Sixth Sand. Elizabeth or Seventh Sand (Hendricks).
Chemung and Portage Beds....	Warren First Sand. Warren Second (Burnside?) Sand. Clarendon or Tiona Sand. Speechley Sand. Balltown or Cherry Grove Sand. Sheffield or Cooper (Riley?) Sand. Benson, Bradford? or Deer Lick Sand. Elk or Waugh and Porter Sand. Kane Sand.
Genesee Shale................	Childress Sand (new) of Cabell County.
Hamilton and Marcellus.......	Gas in Ohio and Kentucky.
Corniferous (Columbus) Limestone..................	Ragland, Menefee, or Irvine Sand of Kentucky.
Oriskany Sandstone...........	Oriskany Sand.

Devonian and Silurian:	
Helderberg (Devonian), Salina and Niagara (Silurian)...	"Big Lime" of Ohio (Newburg Sand near middle).
White Medina Sandstone......	Clinton Sand of Ohio.
Ordovician:	
Martinsburg or Cincinnati Series....................	Hudson Sand Group of Kentucky.
Trenton and Other Limestones (partly Martinsburg Series)..................	Trenton Sand Group of northern Ohio.

In the area under discussion the known productive sands of the Monongahela, Conemaugh, and Allegheny Series, if they ever did, do not now, exist, as they belong above the youngest exposed remaining formations. Limited areas of the Pottsville Series remain but in their present position may be definitely eliminated from prospective oil and gas horizons. In the Mauch Chunk Series the known productive sands outcrop widely and offer little hope of oil or gas.

The Greenbrier Limestone Series, or Big Lime, which attains a thickness of approximately 600 feet, is buried beneath the Mauch Chunk Series along the western border of the county. Its close texture as evidenced by its exposures along the Greenbrier River would tend to minimize its importance as a suitable reservoir for the petroleum hydrocarbons in Pocahontas County.

The Pocono Series, which occurs just below a protective mantle of red shales (Maccrady), contains at least two coarse and porous sandstone conglomerates and is generally below drainage west of the Greenbrier River. It is from the sands of this horizon that gas in small quantities was found in the water wells at Marlinton, and probably the same in the Lewis salt well (No. 3 on Map II). The sands of this series may be regarded as among the most hopeful of the local area, but even these offer slight incentive for drilling.

The Catskill Series, which contains the Venango Group of oil and gas horizons of Pennsylvania and northern West Virginia, is greatly attenuated in thickness in this area. A conglomerate occurring near the middle of this series and noted along the State highway one and one-half miles southeast of Marlinton may be regarded as a prospective sand provided it extends westward with similar character. The late Dr. I. C. White, while on a visit to Pocahontas County, expressed the opinion that this sand might correspond to the Gordon Sand. The underlying Chemung and Portage Series which generally consist of thin sandstone flags, massive sandstones, and shales, and which contain several productive sands in Pennsylvania and West Virginia, outcrop almost entirely east of the Greenbrier River and then pass below drainage west of this river at considerable depth. The Hendricks Sandstone, coming at the top of these beds, would form a suitable reservoir for either oil or gas.

The Genesee Shale, because of its fine-grained and compact character as evidenced by its exposures along the eastern side of the county, would not offer much hope for speculation, even though it has recently been proved productive in Cabell County. The Hamilton and Marcellus Series, composed of sandy and dark carbonaceous shales with thin limestones at the base, have produced gas in Kentucky and Ohio, but are not known to retain either oil or gas in West Virginia. These horizons pass beneath drainage east of the Greenbrier River and do not again come above drainage, being deeply buried in the western limits of the county. The Corniferous Limestone, known as the Ragland, Menefee, or Irvine Sand of Kentucky, where it is cherty and porous and contains oil and gas, has not been definitely recognized in West Virginia, but may be the same as the Huntersville Chert of this area. If this assumption be true and the Huntersville Chert horizon retains its same character several miles farther west, it might deserve further prospecting, the chief difficulty being the great depth at which this horizon occurs in the present proved oil and gas areas.

The Oriskany Sandstone is beneath drainage west of the Greenbrier River and is generally quite porous, forming a suitable reservoir for the retention of either oil or gas. Like the overlying Huntersville Chert, the chief difficulty is the depth that is necessary to reach this horizon in the proved areas of younger formations.

The next underlying limestones, known as the Big Lime of Ohio, comprising the Helderberg, Salina, and Niagara Series, outcrop along the Browns Mountain Anticline in a broken and greatly mashed condition, so that these horizons at this locality are entirely eliminated. Along the western limits of the county these formations lie at such depths below the surface as to render their prospects quite impracticable.

The White Medina Sandstone, which is known as the "Clinton" Sand in southeastern Ohio where it is a productive sand, outcrops along the Browns Mountain Anticline, where it is broken and squeezed, being 50 to 150 feet in thickness and very hard and quartzitic. In the western portion of the county this horizon lies below the general depth reached by the present methods of drilling.

OIL AND GAS WELL RECORDS.

In Pocahontas County only two wells have been drilled for oil, neither of which obtained any production, although a show of oil was reported in the Pocahontas Coal and Land Company's No. 1 (No. 1 on Map II) well. The record of this well, a copy of which was kindly furnished by Mr. Hubert Echols, of Marlinton, a Director of the Company, and earlier published in the Webster County Report, is included with the Big Spruce Knob Section, and can be seen on pages 103-4. Some changes in correlation in the lower part of this record have been made in this report. This well was drilled on the lands of the Pocahontas Coal and Land Company, along Williams River slightly southwest of Big Spruce Knob, where the strata are rising rapidly to the east, with all the horizons penetrated being exposed at the surface a few miles farther east so that any hope of finding either oil or gas is very remote.

The remaining well that was drilled for oil in this county was the G. B. Slaven No. 1 (No. 2 on Map II), located one-fourth mile southwest of Green Bank. The well was reported drilled by J. J. De Ran, of Bel Air, Maryland, and Charles Hines, of Baltimore, Maryland, to a depth of 800 to 900 feet. The date of the drilling is not known but the bull-wheel remains at the location at this date.

The surface rocks here are the black carbonaceous Marcellus Shales which have been greatly squeezed and mashed. According to tradition a few years previous to the date of drilling lightning struck the ground near this point and ignited the shales which burned for several days. Believing the ground was literally saturated with oil the Slaven well was drilled. Unfortunately no record of the strata penetrated is available. In some respects the well was structurally well located, being on the northwestern slope of the plunging Browns Mountain Anticline, with the Oriskany Sandstone a short distance beneath the surface so that the deeper horizons were easily in reach of the modern drill. There is little hope, however, of finding either oil and gas, due to the fact, as pointed out on previous pages, that these rocks have been so squeezed and broken that any liquid hydrocarbons that they may have originally contained have been permitted to escape.

SALT AND WATER WELL RECORDS.

Lewis Salt Well (No. 3 on Map II).

The Lewis salt well was drilled on Stony Creek 0.8 mile northwest of Campbelltown with an elevation at the mouth of 2220′ B. The information regarding this well was furnished by Dr. James Price of Marlinton. That there was a salt spring here is not doubted. During the war of 1812 in an attempt to increase the flow of salt water a hole was drilled by means of a spring-pole. According to tradition gas was struck at a depth of 480 feet and with such pressure as to lift the tools so high in the well that when they dropped back the rope or cable broke and the tools remain there to this day. When the well blew out the drillers were scared away, but upon their return the following day the hole had caved in and the salt water had quit flowing.

It is doubtful if this well reached the above depth. The gas was probably struck in the Berea Sand which would occur at 250 to 300 feet below the mouth of the well.

MARLINTON WATER WELLS.

During the period from 1905 to 1910 Mr. John Alexander drilled several water wells east of the present tannery in order to furnish the town with a good supply of pure water. Unfortunately Mr. Alexander could not locate his records of these wells but offered the following information from memory:

John Alexander No. 1 Water Well.

Drilled for water about 1905. Elevation at mouth 2125′ B.

Silt.
Quicksand.
Sand with an inexhaustible supply of water at 100 feet.
Blue clay, 2.5 feet, at 150 feet.
Salt water at 220 feet.
A flowing well but plugged in 1908.

The water would appear to come from the Berea.

John Alexander No. 2 Water Well.

Drilled for water but deepened in the hope of finding gas about 1909. Location just west of the present power-house.

Good flow of blue water at 400 feet.
3-foot pebbly rock at 480 feet. Gas struck at this horizon and produced sufficient gas to light the plant.
Drilled to 1000 feet.

John Alexander No. 3 Water Well.

Drilled about 1909. Location, 15 feet east of No. 2.

A good flow of water was struck at 100 feet which supplied the town of Marlinton until 1925. It had a daily capacity of 100,000 gallons.

Ice Plant Water Well.

This well, owned by W. C. Householder, was drilled to a depth of 100 feet where an inexhaustible supply of water was found. This water is used for making ice as well as drinking purposes.

The one hundred-foot depth at which a good supply of water was struck in all the wells except the John Alexander

No. 2, which was not reported because gas was being sought, is apparently the Berea Sandstone. The gas reported from the same well is probably from the conglomerate found near the middle of the Catskill Series.

PETROLEUM RESIDUUM.

Attention should be called to the presence of a lenticular deposit of solid hydrocarbons beneath the flood-plain terrace at the south end of the Greenbrier Tannery at Marlinton. This deposit was brought to the attention of the writer by Dr. James Price of Marlinton, who, being a very close observer, noticed in a sewer excavation the uncovering of black shiny carbonaceous material. The substance was struck at a depth of two feet, being covered by an alluvial deposit of sand and gravel that contained fragments of wood. The deposit attained a thickness of three feet, but thinned out to nothing on either side. A sample was collected by Dr. Price, a portion of which was given to the writer.

A megascopic examination revealed a jet-black shiny solid, breaking with a conchoidal fracture, but by transmitted light revealed a beautiful amber to cherry-red color. An analysis of this material by Dr. B. B. Kaplan, Survey Chemist, shows the following composition:

	Per cent.
Moisture	7.92
Volatile Matter	59.48
Fixed Carbon	30.86
Ash	1.74
Total	100.00
Calorimeter B. T. U. (dry basis)	8,907.

It is the writer's opinion that during comparatively recent geologic time much oil has escaped from the fissured and broken sands and has been carried away by present streams, and that the Marlinton deposit is the residue of a petroleum that was caught in a protected depression, while the more volatile hydrocarbons evaporated.

SUMMARY OF OIL AND GAS POSSIBILITIES IN POCAHONTAS COUNTY.

It would seem to the writer in view of the foregoing statements that any attempt to locate oil in Pocahontas County would be very unwise, with the hope of finding gas in paying quantities but little better. This opinion is reached because of the fact that many of the producing sands are folded and broken while the remaining known producing sands are exposed at the surface within the limits of the county, and have been subjected to incipient metamorphism as a result of folding so that any oil or gas they may have once contained has been permitted to escape.

This same opinion was held by the late Dr. I. C. White, the world's foremost authority on oil and gas, who expressed the following in a letter to the writer on August 14, 1926:

> "It is almost certain that if the people should put their money into drilling for oil in Pocahontas they will never see any of it again. Hence if they are determined to drill arrange to get a complete log of the boring since that is about the only valuable thing that will result from the expenditure."

COMMERCIAL COAL.

GENERAL STATEMENT.

In Pocahontas County coals are found in the Pocono and Mauch Chunk Series of the Mississippian and the Kanawha and New River Groups of the Pottsville Series, but it is only in the latter two groups that coals of commercial value and minable thickness are found, the Pocahontas Group of the Pottsville Series that contains the famous Pocahontas Coals of southern West Virginia being entirely absent in this area. The coals of the Kanawha and New River Groups that are present in this county are confined to the western limits of Little Levels, Edray, and Greenbank Districts.

Of the five Pottsville coals which occur in this county there are three which appear to have a definite minable thickness in some localities, while a fourth,—the Fire Creek,—

may be found to be of commercial value at some points.

The three beds regarded as minable in some localities in descending order are the Gilbert, Hughes Ferry, and Sewell Coals. These three coals, only, will be given tonnage estimates in this report, with brief mention of certain others, while the remaining seams have already been described in the Chapters on Stratigraphy so far as they pertain to the area of this report.

Attention has been called earlier in this report to the difficulty of getting sufficient and accurate data in the present area underlain by coals. The region is that of a high plateau greatly dissected by erosion that has left deep and often precipitous gorges, the escarpments of which are covered by vast accumulations of detritus from the Pottsville rocks, along with abundant vegetation much of which is almost impenetrable second growth. These young trees and plants, especially along the lateral streams where observations are generally available, are interspersed with dis carded logs and limbs so that travel is very difficult. With this brief description of the conditions under which the present observations were made, it is hoped that the results will not be considered as final, but will form a basis by which future prospecting can be done in detail and with much more accuracy.

Attention should also be called to the table of coal analyses, the results of which should not be considered as representative, because of the fact that there are no commercial mines in the area and none that has been sufficiently opened so that unweathered samples could be secured. Under these conditions it was necessary to take samples from weathered outcrops and in some cases fragments from old prospecting dumps, the analysis of which could not possibly reveal the true composition of the coals.

Because of their distance from permanent railroads and coal markets, and their general inaccessibility, their development will undoubtedly be in the somewhat distant future, but should nevertheless be considered as one of the county's valuable potential resources.

There are no commercial mines in Pocahontas County nor have there been any test borings to determine the presence of coals in this area.

MINABLE COAL, KANAWHA GROUP.

GILBERT COAL.

It is only the lower portion of the Kanawha Group that remains in Pocahontas County, the upper portion having been removed by erosion. This lower part contains the Gilbert Coal and is now retained only high in the hilltops in Little Levels, Edray, and Greenbank Districts. Figure 18 shows the general region over which it is believed to be present. On Map II its outcrop is delineated for the portions of the county where openings were found or where, because of a sufficient interval from a lower coal, it is believed to be present, although its outcrop was not seen. As a rule the coal is soft and columnar but often contains shale or sandstone partings.

Gilbert Coal, Greenbank District.

In Greenbank District no outcrop of the Gilbert Coal was seen. Its presence, however, in at least three high knobs along the structural basin of Cheat and Back Allegheny Mountains was postulated from its occurrence on Snyder Knob of Cheat Mountain, 0.7 mile west of Hopkins, Randolph County. At this point coal has been mined by the W. Va. Pulp and Paper Company for use in its lumber operations. The following section shows the thickness of the Gilbert Coal as revealed by the No. 1 Coal Test Boring[2] (No. 19 on Map II) of this company:

				Ft.	In.
Sandstone, Lower Gilbert					
Coal	0′	6″	Gilbert (4404′ B.)	5	8
Sandstone	0	10			
Coal	4	4			
Fire clay					

[2]David B. Reger, The Cheat Mountain Coal Field of Randolph County, West Virginia; Bull. 3, W. Va. Geol. Sur., p. 14; 1928.

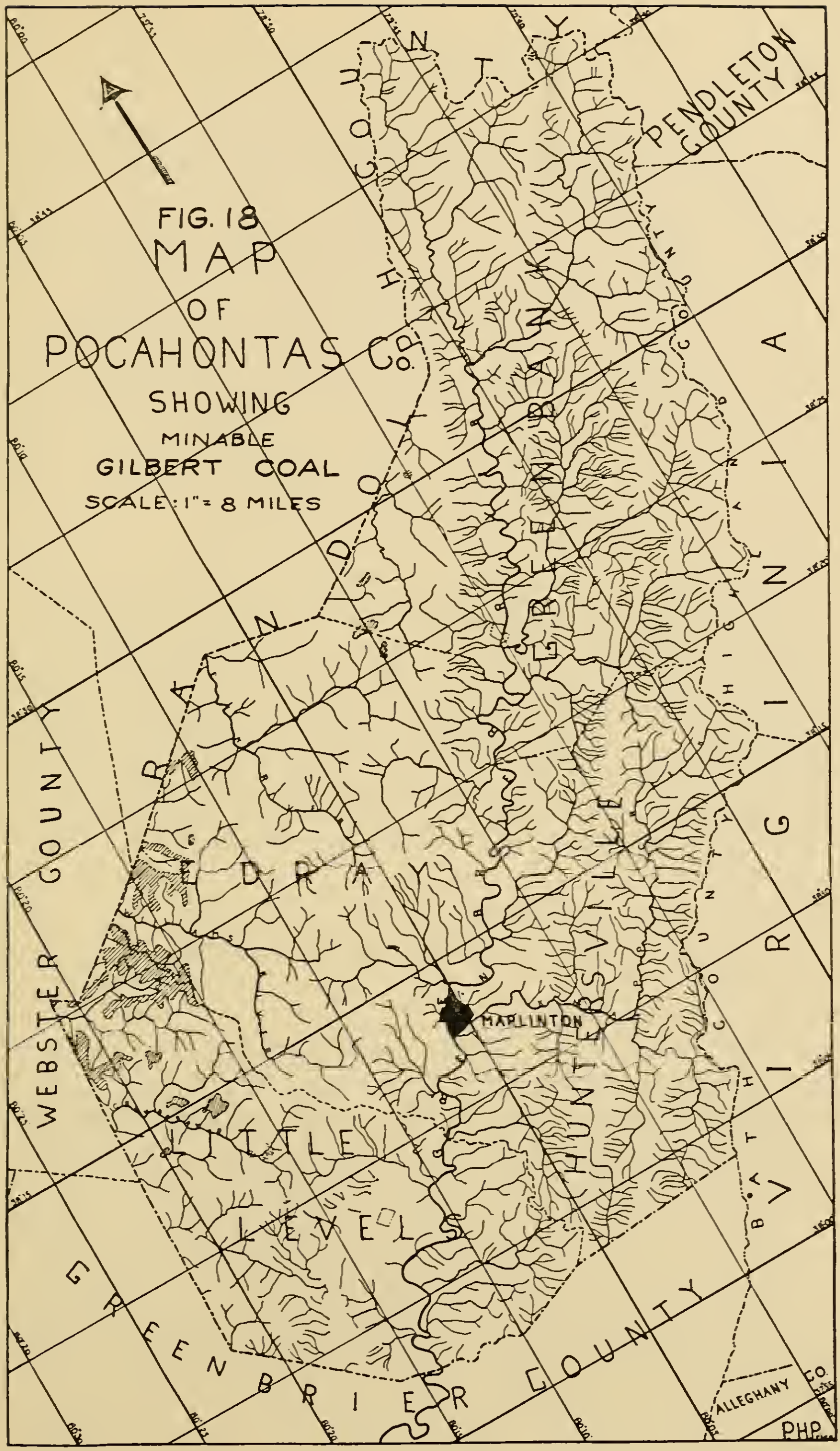
FIG. 18
MAP
OF
POCAHONTAS CO.
SHOWING
MINABLE
GILBERT COAL
SCALE: 1" = 8 MILES
RANDOLPH COUNTY
PENDLETON COUNTY
GREENBANK
EDRAY
MARLINTON
HUNTERSVILLE
LITTLE LEVELS
WEBSTER COUNTY
GREENBRIER COUNTY
HIGHLAND COUNTY
BATH COUNTY
VIRGINIA
ALLEGHANY CO.
PHP

An analysis of this coal at this location as published in the same report and as analyzed on a moisture-free basis by company chemists, is as follows:

	Per cent.
Moisture	......
Volatile Matter	30.81
Fixed Carbon	57.07
Ash	12.12
Total	100.00
Sulphur	0.80
B. T. U.	13,556

Gilbert Coal, Edray District.

In Edray District, also, the Gilbert Coal is retained only in the tops of the high knobs, these being in the extreme western limits along the Webster County line. No prospects, so far as known, have been made at the Gilbert horizon, the region being mostly covered with a dense forest growth. This region, however, should have much the same coals as those found immediately to the west in Webster County, and the Gilbert is therefore indicated on Figure 18, in the belief that prospecting at the proper horizon would reveal it.

Gilbert Coal, Little Levels District.

In Little Levels District, as in the two preceding districts, the Gilbert Coal is retained only in the tops of the highest ridges. It is in this district, however, that the greatest amount of this coal remains. So far as known no coal has been mined from this seam and very little prospecting has been done, the region being covered with a dense cover of second-growth timber, so that prospecting at the horizon at which this coal would occur is exceedingly difficult. With Joseph A. Sharp as a guide the following opening in the Gilbert Coal was made on Cranberry River drainage:

Cherry River Boom and Lumber Company Prospect—No. 14 on Map II.

At head of Little Red Run 3 miles northwest of Cranberry Glades; Gilbert Coal; elevation, 4150′ B.

			Ft.	In.
Shale, yellow and brown				
Coal, good	0′	6″		
Coal, bony	0	6		
Coal, good	1	2		
Sandstone, with carbonized plants	1	4		
Coal, fair	3	1		
Shale, dark	0	3	6	10
Concealed				

Quantity of Gilbert Coal Available.

The following table, compiled by George W. Grow from a planimetric measurement of the outcrop on Map II, shows the probable amount of Gilbert Coal by districts in Pocahontas County. From the preceding measured sections the assumed thickness of three feet may seem too small but allowance is made for the generally patchy nature of this coal and the amount wasted in discarding the bony partings:

Probable Amount of Gilbert Coal.

Pocahontas County by Districts.	Thickness of Coal Assumed Feet.	Square Miles.	Acres.	Cubic Feet of Coal.	Short Tons of Coal.
Little Levels	3	7.30	4,672	610,536,960	24,421,478
Edray	3	5.55	3,552	464,175,360	18,567,014
Greenbank	3	0.26	166	21,692,880	867,715
Totals		13.11	8,390	1,096,405,200	43,856,207

MINABLE COALS, NEW RIVER GROUP.

HUGHES FERRY COAL.

The Hughes Ferry Coal, previously discussed in Chapter VI, pages 134-5, and being mainly preserved in the extreme western portions of Edray and Little Levels Districts, appears to be of minable thickness in the greater part of the area in which it is retained. Although no exposures were noted its occurrence is postulated in the extreme western and southern portions of Greenbank District, along the southern end of the North Potomac (Georges Creek) basin, because of its relative position in the series. In neighboring regions its thickness varies from 18 inches to approximately four feet, and when found in minable thickness it is a pure, soft coal, of columnar structure, and of typical New River character. On Map II the outcrop of this coal is shown, while Figure 19 indicates the areal extent of the same territory.

Hughes Ferry Coal, Greenbank District.

As previously noted the presence of the Hughes Ferry Coal in Greenbank District has not been definitely proved but it is believed to be present in certain high points, because of the presence of its horizon in the remaining rocks and because it is recorded in the borings of the West Virginia Pulp and Paper Company's core drills.[3] The areas that are believed to contain this coal are shown on Map II as well as on Figure 19, page 291.

Hughes Ferry Coal, Edray District.

In Edray District the Hughes Ferry Coal probably reaches its best development. Although it has not been mined there are several points at which it outcrops, the following exposures being noted:

Cherry River Boom and Lumber Company Prospect—No. 4 on Map II.

On east side of Black Mountain, one mile southwest of junction of Laurel Creek with Williams River; **Hughes Ferry Coal**; elevation, 4180′ B.

	Ft.	In.
1. Slate, dark	..	..
2. **Coal**, soft, columnar, good	3	4
3. Slate, pavement	..	..

[3]Op. cit.

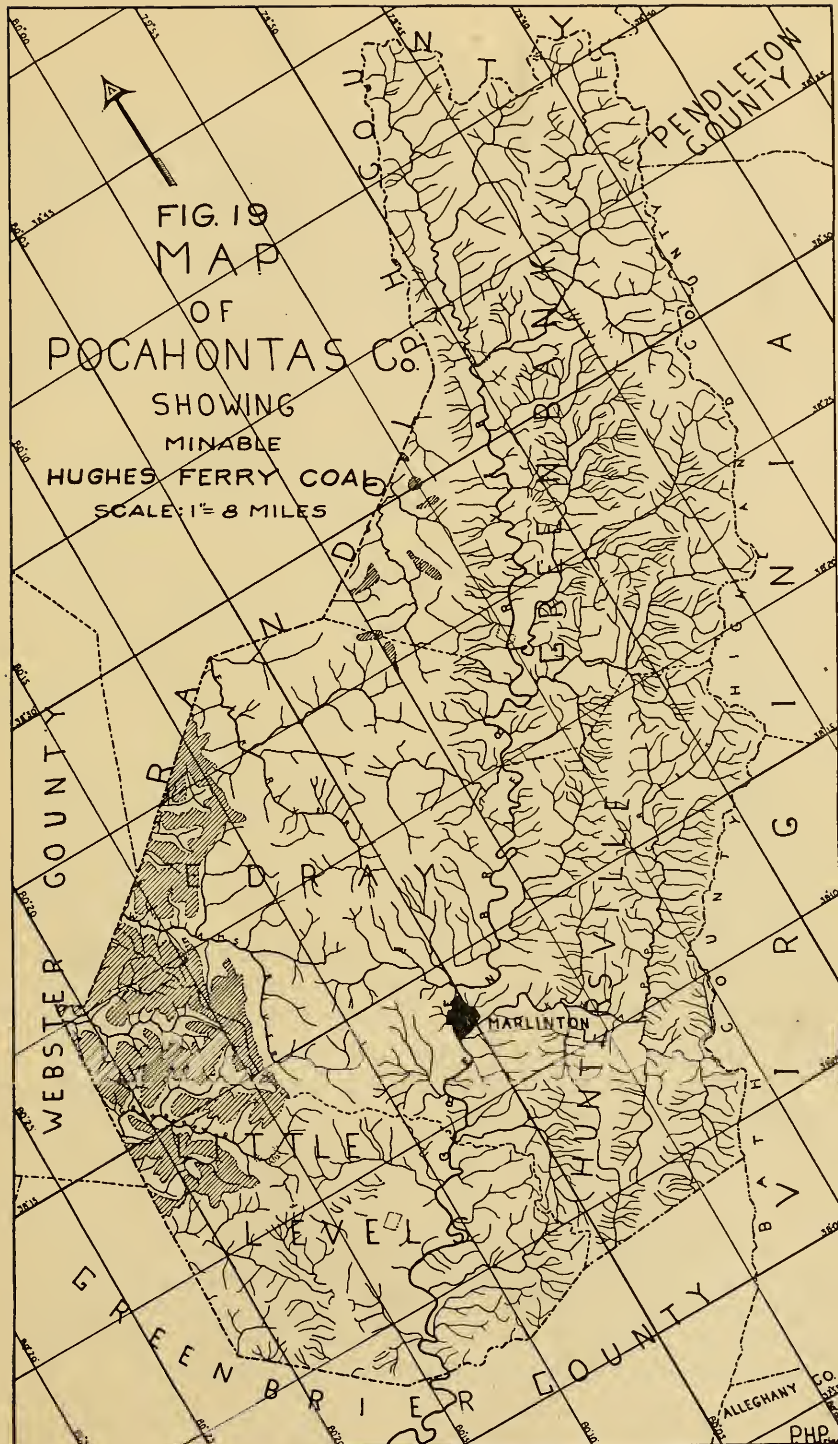
FIG. 19
MAP
OF
POCAHONTAS CO.
SHOWING
MINABLE
HUGHES FERRY COAL
SCALE: 1" = 8 MILES
RANDOLPH COUNTY
PENDLETON COUNTY
HIGHLAND COUNTY
VIRGINIA
WEBSTER COUNTY
GREENBRIER COUNTY
BATH COUNTY
ALLEGHANY CO.
GREENBANK
EDRAY
HUNTERSVILLE
LITTLE LEVELS
MARLINTON
PHP

A sample (No. 47 PH) was collected from No. 2 of this section, the composition of which is published under **Mine No. 4** in the Table of Coal Analyses at the end of this chapter.

Pocahontas Coal and Land Company Prospect—No. 5 on Map II.

On Williams River, 0.7 mile west of mouth of Day Run; Hughes Ferry Coal; elevation, 4200′ B.

			Ft.	In.
1. Sandstone, grayish-brown, coarse			..	..
2. Slate, dark	1′	6″		
3. Coal, good, clean	3	4		
4. Coal, fair	0	6	5	4

At the time of the writer's first visit to this prospect the opening had fallen shut. A sample (No. 67 PH), however, was taken from loose pieces on the dump, which probably accounts for the low B. T. U. The composition is shown under **Mine No. 5** in the Table of Coal Analyses at the end of this chapter.

Coal Prospect No. 8 on Map II, located on Laurelly Branch of Middle Fork, about three-fourths mile southwest of mouth, at an elevation of 3245′ B., which seems to represent the Hughes Ferry horizon, had fallen shut. It was reported, however, to have been three feet four inches in thickness.

The **Cherry River Boom and Lumber Company Prospect (No. 10 on Map II)**, located near the head of the south fork of Elbow Run, just across the line in Webster County, with an elevation of 3165′ B., which appears to represent the Hughes Ferry horizon, measured 18 inches, with a one-inch streak of bone six inches from the top.

Hughes Ferry Coal, Little Levels District.

No exposures of the Hughes Ferry Coal were noted in Little Levels District, but its presence is fairly accurately assumed from its occurrence in the adjoining district of Edray on the north and Webster County on the west. The area assumed to be underlain with Hughes Ferry Coal in the district is now covered at the surface by a dense growth of young timber so that prospecting is very difficult. In the adjoining county of Webster, Reger[4] records a 3′ 3″ bed of clean, soft coal in Little Fork of Williams River, 1.4 miles southward from Three Forks of Williams, just three-fourths mile west of the Pocahontas County line at an elevation of 3325′ B.

Quantity of Hughes Ferry Coal Available.

The following table, prepared by George W. Grow, from a planimetric measurement of the outcrop on Map II, gives the probable amount of Hughes Ferry Coal in Pocahontas County:

Probable Amount of Hughes Ferry Coal.

Pocahontas County by Districts.	Thickness of Coal Assumed. Feet.	Square Miles.	Acres	Cubic Feet of Coal.	Short Tons of Coal.
Little Levels............	3	34.06	21,798	2,848,562,640	113,942,506
Edray	3	21.02	13,453	1,758,038,040	70,321,522
Greenbank	3	1.85	1,184	154,725,120	6,189,005
Totals	....	56.93	36,435	4,761,325,800	190,453,033

SEWELL COAL.

The Sewell Coal, previously discussed in Chapter VI, pages 136-7, is perhaps the most valuable and persistent bed that occurs in Pocahontas County, having a comparatively wide distribution over the western portion of Edray and Little Levels Districts, with a few scattered areas along the western and southwestern portions of Greenbank District. Its thickness varies from 3 to 6 feet but it contains one or more partings. The analyses as published at the end of this chapter can not correctly portray the true composition of

[4]David B. Reger, Webster County Report, W. Va. Geol. Sur., p. 436; 1920.

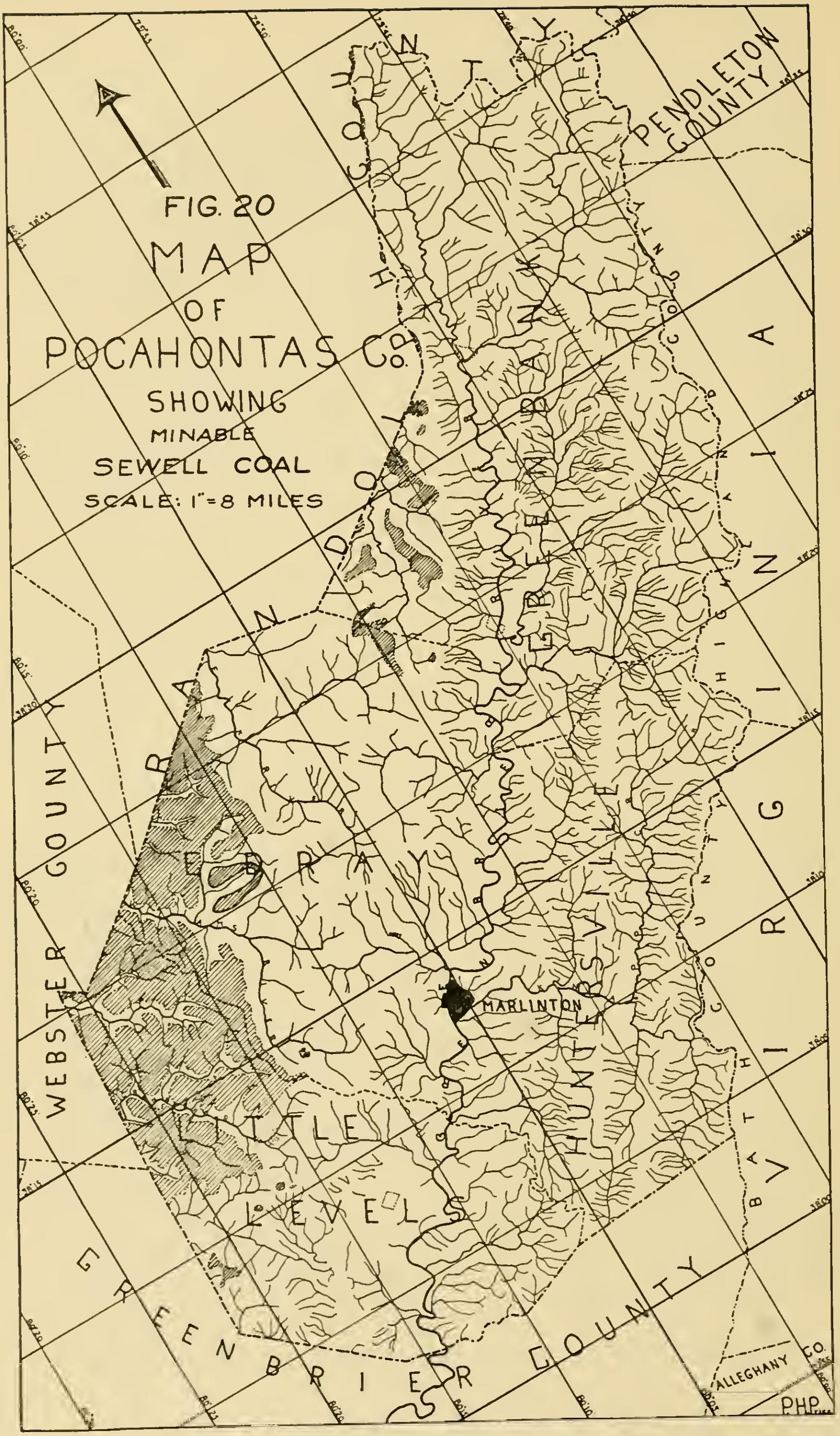
FIG. 20
MAP
OF
POCAHONTAS Co.
SHOWING
MINABLE
SEWELL COAL
SCALE: 1" = 8 MILES
RANDOLPH CO.
PENDLETON COUNTY
HIGHLAND COUNTY
VIRGINIA
WEBSTER COUNTY
GREENBRIER COUNTY
BATH COUNTY
ALLEGHANY CO.
MARLINTON
LITTLE LEVELS
EDRAY
HUNTERSVILLE
GREENBANK
P.H.P.

this and other coals, as there are no commercial mines operating in the county, and all samples were necessarily taken from weathered exposures. In spite of these conditions the analyses show a relatively high carbon content as well as relatively low volatile matter, also a low sulphur content but a rather high ash content. The latter is probably due in some cases to non-combustible matter that has been deposited along the joint-planes in weathering. Its outcrop is shown on Map II and Figure 20 indicates the areal extent in the same territory.

Sewell Coal, Greenbank District.

In Greenbank District no exposures of the Sewell Coal were seen but its presence is almost a certainty because of its occurrence in adjoining areas to the north and west. Along Back Allegheny Mountain and just north of the Pocahontas County line a coal that appears to correspond to the Sewell horizon has been opened and reported to have a thickness of three feet. Along the North Potomac (Georges Creek) Syncline, where several core tests have been drilled by the West Virginia Pulp and Paper Company, the Sewell Coal is present, although varying considerably in thickness, and often containing a slate parting. (See Bull. 3, W. Va. Geol. Sur., 1928). In Figure 20, those areas in Pocahontas County that should contain the Sewell are shown.

Sewell Coal, Edray District.

In Edray District the Sewell Coal has been prospected at a few points. Throughout most of this territory the coal is relatively clean although occasionally containing a shale parting. The coal is generally found high up against the mountains as the streams have cut deep channels into the red shales of the Mauch Chunk Series, so that inclines of considerable length will be required to handle it.

The following prospects were examined in Edray District:

Cherry River Boom and Lumber Company Prospect—No. 3 on Map II.

On the east side of Black Mountain 0.8 mile southwest of junction of Laurel Creek with Williams River; **Sewell Coal**; elevation, 4000′ B.

		Ft.	In.
Shale, Hartridge, black			
Coal, soft, clean	1′ 5″		
Bone	0 1		
Coal, soft, clean	1 2	2	8
Shale			

A sample (No. 46 PH) was collected from this outcrop, the composition of which appears under **Mine No. 3** in the Table of Coal Analyses at the end of this chapter.

On the property of the Pocahontas Coal and Land Company a prospect that occurred at the Sewell horizon had fallen shut. A few blocks of coal were separated from the old dump for analysis the results of which are recorded in the Table of Coal Analyses under **Sample No. 48**. A thickness of 40 inches of coal was reported for this prospect.

Cherry River Boom and Lumber Company Prospect—No. 6 on Map II.

On a branch of Middle Fork which empties into the latter stream one mile above McClintock Run; **Sewell Coal**; elevation, 3725′ B.

		Ft.	In.
Sandstone, grayish-brown, shaly		..	..
Slate	1′ 6″		
Coal, clean	0 6		
Slate	1 4		
Coal	1 0 +	4	4
Base concealed			

The entire exposure of this coal could not be seen but it is reported to have been mined by Mr. Withrow McClintock in lumber operations several years earlier.

Cherry River Boom and Lumber Company Prospect—No. 16 on Map II.

Near head of Laurel Run, 2.5 miles southwest of Slaty Fork; **Sewell Coal**; elevation, 4225′ B.; measured by David B. Reger.

		Ft.	In.
Coal, medium-soft	5′ 1″		
Concealed, with coal reported	7 0		
Coal	1 0	13	1

This prospect is very hard to locate unless accompanied by someone who knows its exact location. It is here that the Sewell Coal probably attains its greatest thickness at any point in the county. Because of its high position in the mountain it would be difficult to operate.

Sewell Coal, Little Levels District.

Coal has been mined commercially only in Little Levels District. Several years ago the Sewell Coal was mined quite extensively, for that time, for lumber operations and household use in the vicinity of Hillsboro. It was necessary to transport the coal by wagon along the steep and treacherous road that leads from the opening. To-day the openings in this coal have all fallen shut, but with the aid of Walter Mason and Lee Clark of Marlinton, a partially successful attempt was made to reopen one of the old entries. Here the following section was measured:

Preston Clark Heirs Prospect—No. 11 on Map II.

On west side of Briery Knob one-half mile northwest of triangulation station and Fire-Tower; Sewell Coal; elevation, 4225′ B.

		Ft.	In.
Shale, Hartridge; plants and pelcypods		..	..
Coal, good, clean	2′ 2″		
Shale, argillaceous	1 10		
Coal, clean	1 3		
Coal, bony	1 0	6	3
Concealed			

It is doubtful if the complete thickness of the coal here is revealed by this section. Mr. Lee Clark, who had been in the mine, reported as much as eleven feet at certain points.

A sample (No. 62 PH) of this coal was taken, the composition of which appears under **Mine No. 11** in the Table of Coal Analyses at the end of this chapter.

In Lost Run of Cranberry River another coal that appears to be the Sewell was examined. At this point the coal seems quite irregular and contains a thick shaly parting:

Cherry River Boom and Lumber Company Prospect—No. 15 on Map II.

On Lost Run of Cranberry River three miles northeast of Cranberry Glades; Sewell Coal; elevation, 3625' B.

			Ft.	In.
Sandstone, grayish-brown, with carbonized plants				
Coal, clean	0'	6"		
Shale	0	3		
Coal, clean	0	11		
Shale, slaty; roots and stems	8	8		
Coal, good, clean	1	0	11	4
Shale, slate pavement			8	0

Quantity of Sewell Coal Available.

The following table, prepared by George W. Grow from a planimetric measurement of the outcrop on Map II, which embraces the areal district outlined on Figure 20, shows the probable amount of Sewell Coal in Pocahontas County:

Probable Amount of Sewell Coal.

Pocahontas County by Districts.	Thickness of Coal Assumed. Feet.	Square Miles.	Acres.	Cubic Feet of Coal.	Short Tons of Coal.
Little Levels	3	46.85	29,984	3,918,309,120	156,732,365
Edray	3	28.85	18,464	2,412,875,520	96,595,021
Greenbank	3	6.28	4,019	525,202,920	21,008,117
Totals		81.98	52,467	6,856,387,560	274,335,503

FIRE CREEK COAL.

The Fire Creek Coal, previously discussed in Chapter VI, pages 137-8, and coming only a few feet above the red Mauch Chunk Shales, is not generally of sufficient thickness to be classified as a commercial coal. Its presence, however, was found to be quite constant, especially in Little Levels District and southwestern Edray District. In the adjoining county of Webster in southeastern Glade District, Reger[5] found the Fire Creek Coal to be of minable thickness. Along Dogway Fork in the vicinity of Dogway the following section was measured by Reger:

Cherry River Boom and Lumber Company Prospect—(No. 754 on Map II, Webster County Report).

On Dogway Fork of Cranberry River, 0.5 mile northward from Dogway village; Fire Creek Coal; elevation, 3060′ B.

			Ft.	In.
1.	Shale, sandy		20	0
2.	Coal, soft	2′ 0″		
3.	Slate, black, bony	1 0		
4.	Coal	1 6	4	6

A sample was collected from Nos. 2 and 4 of section, the composition of which is as follows:

	Per cent.
Moisture	2.95
Volatile Matter	30.87
Fixed Carbon	60.87
Ash	5.31
Total	100.00
Sulphur	0.71
Phosphorus	0.001

In the same district and just 1½ miles north of this latter prospect, this coal was again noted where the following section was measured:

Cherry River Boom and Lumber Company Prospect—No. 12 on Map II.

On north side of Cranberry River in Webster County, one-fourth mile west of Pocahontas County line; Fire Creek Coal; elevation, 3000′ B.

	Ft.	In.
Sandstone, grayish-brown, fine-grained, platy, with mud-cracks and ripple-marks	5	0
Shale, variegated, alternating with fine-grained flags 1″ to 3″ thick	15	0
Coal, good, clean	1	4
Shale, black, carbonaceous	3	0

[5]David B. Reger, Webster Report, W. Va. Geol. Sur., pp. 491-493; 1920.

At the **Cherry River Boom and Lumber Company Prospect, (No. 7 on Map II)**, on the east side of Hell for Certain Branch of Middle Fork, one-half mile southeast of mouth, at an elevation of 3225′ B., 18 inches of clean coal (Fire Creek) was measured. This coal was reported to be 28 inches and had previously been mined for fuel in the log camps.

On Laurelly Branch at an elevation of 3090′ B., at the **Cherry River Boom and Lumber Company Prospect (No. 9 on Map II)**, a coal believed to be the Fire Creek horizon measured only 6 inches.

It can therefore be seen that the Fire Creek, although generally present, is too thin to operate with present mining methods, and although having a potential value, its operation is destined to be in the distant future. For this reason its probable amount is not estimated for Pocahontas County.

SUMMARY OF AVAILABLE COAL.

For convenient reference all the prospects and exposures described in this report have been given serial numbers which are printed in blue on Map II, ranging from 1 to 19, along with the openings in Webster County in which case the original numbers were retained. In some cases coals which have no apparent value are included in the discussion so that this fact may also be shown, but in the following table only those coals that appear to have a commercial value are included:

Summary of Available Coal by Districts, Pocahontas County.

Coal Bed.	Little Levels District.	Edray District.	Greenbank District.	County Totals.
Gilbert	24,421,478	18,567,014	867,715	43,856,207
Hughes Ferry....	113,942,506	70,321,522	6,189,005	190,453,033
Sewell	156,732,365	96,595,021	21,008,117	274,335,503
Totals	295,096,349	185,483,557	28,064,837	508,644,743

TABLE OF COAL ANALYSES.

In the following brief table, containing the proximate analyses of samples from ten openings or prospects, the work has been done by the Survey Staff, with the exception of No. 19, which was analyzed by chemists of the West Virginia Pulp and Paper Company. With this one exception all the samples were taken in the field by the writer and analyzed in the laboratory of the Survey by B. B. Kaplan. Chemist. Along with the general composition and B. T. U. is included the Fusing Point of Ash. In the last column will be seen the carbon ratio which was computed by the writer.

Attention has already been called to the conditions under which the samples were taken, being in most cases from exposed and weathered outcrops:

Table of Coal Analyses.

(All samples analyzed on "as received basis).

No. on Map II.	Sample No.	Laboratory No.	Mine Prospect or Exposure.	Coal Bed.	Proximate.					Calorimeter B. T. U.	Fusing Point of Ash. °F.	Carbon Ratio. (F. C. / F. C.+V. M.)
					Moisture.	Volatile Matter.	Fixed Carbon.	Ash.	Sulphur.			
19	......	......	W. Va. Pulp & Paper Co., Hopkins (a)....	Gilbert	......	30.81	57.07	12.12	0.80	13,556	......	65
4	47 PH	3105	Cherry River Boom & Lumber Co........	Hughes Ferry.....	1.84	27.76	64.20	6.20	0.70	12,509*	2417	70
5	67 PH	3098	Pocahontas Coal & Land Co............	Hughes Ferry.....	4.58	22.66	48.14	24.62	0.37	11,143*	2810	68
10	57 PH	3107	Cherry River Boom & Lumber Co........	Hughes Ferry.....	3.70	22.50	35.58	38.22	0.39	....	2850	62
3	46 PH	3070	Cherry River Boom & Lumber Co........	Sewell	2.16	25.04	62.38	10.42	0.56	12,940	2805	71
..	48 PH	3106	Pocahontas Coal & Land Co............	Sewell	0.36	22.29	66.75	10.60	0.68	13,740	2850	75
7	56 PH	3097	Cherry River Boom & Lumber Co........	Sewell	0.64	27.36	65.98	6.02	0.61	14,440	2850	71
11	62 PH	3099	Preston Clark Heirs....................	Sewell	1.50	23.24	63.36	11.90	0.62	12,213	2850	73
17	55 PH	3107	Cherry River Boom & Lumber Co., Three Forks of Williams, Webster County.....	Sewell	0.21	27.50	64.64	7.65	0.69	13,950	2750	70
2	54 PH	3096	Calvin May..........................	Merrimac (Pocono).	0.56	12.22	60.16	27.06	5.59	10,095	2174	83

*Much weathered, which probably accounts for the low B. T. U.
(a) Analyzed on a moisture-free basis by company chemists.

CHAPTER XIII.

WATER-POWER, MINERAL WATERS, IRON ORE, MANGANESE, AND PRECIOUS METALS.

WATER-POWER.

PRESENT DEVELOPMENT.

At the present time no utilization is being made of the many streams of Pocahontas County for hydroelectric power, nor can it be said that these streams offer attractive sites for such development. A point that should be kept in mind, however, is that the majority of the rivers of West Virginia have their source in Pocahontas County and are therefore integral parts of streams that do offer possibilities for hydroelectric development.

Stamping Creek is used to operate a small turbine for electric power. At Clover Lick Mr. Coyner is preparing to install a small turbine near the mouth of Cloverlick Creek to operate an electric generator.

Probably the greatest use to which the streams are put, and even this is infrequent and of small consequence, is to propel overshot water-wheels to grind flour and feed. In the latter way there remain five mills that operate intermittently throughout the year. These mills are as follows:

Name of Mill.	Location.	Owner.
Mill Point	On Stamping Creek at Mill Point	H. W. McNeel
Hogsett	On Stamping Creek at Mill Point	T. W. Hogsett
Locust Creek	On Locust Creek	Wallace McCoy
Geiger (Turbine)	On Stony Creek	Godfrey Geiger
Heavener	North Fork, at Arbovale	J. B. Orndorff.

AVAILABLE STREAMS.

Greenbrier River.

The drainage basin of the Greenbrier River has already been described, pages 41-48, together with records of stream gages and references to others which have been maintained along this stream, and which have been published in the various Water-Supply Papers of the United States Geological Survey. Other than near its source this river has a moderate rate of fall (see gradient of Greenbrier River, page 42), and along its course are several narrows where dams could be built with secure foundations. Furthermore the rate of silting would be comparatively slow as the greater number of its tributaries as well as a large part of the river itself flows across areas that are largely covered by a heavy growth of vegetation. Along the immediate valley there are no minerals of great economic importance that would be flooded, there being neither coal nor limestone below the necessary level. In Greenbrier County just south of the Pocahontas County line a narrow gorge is formed at which a secure foundation could be had. A dam 100 feet high at this point would pond the water to the mouth of Chicken House Run, and would form an artificial lake that would attain a width of three-fourths mile at certain points.

The chief objection to a dam along this river, however, which in itself is perhaps prohibitive, would be encountered in the tracks of the Chesapeake and Ohio Railway which closely parallel this stream. These tracks are located in most cases from 15 to 30 feet above the stream bed so that high dams could not be built without a very large expense in relocation of the tracks, which in itself is entirely impractical if not almost impossible as the river valley is the only practical location for a railroad in the county.

Knapp Creek.

Knapp Creek, which is tributary to Greenbrier River at Marlinton and which has been described on page 51, has certain features that warrant attention from the standpoint of power development on a small scale. These favorable features, however, are probably outnumbered by the disadvantages created by such a development. Along the Knapp Creek gorge between Marlinton and Minnehaha Springs there are several narrows where high dams could be built with secure foundations. If a dam should be built at the upper end of the gorge near Minnehaha Springs an artificial lake of large dimensions could be secured but it would not only cut off one of the most important arteries of travel to the county-seat but would flood hundreds of acres of valuable farm land.

INDICATED HORSE-POWER OF STREAMS.

The following table gives the indicated horse-power developed by streams in Pocahontas County, in whole or in part, having been taken from Tables 3 and 4, pages 401 and 402, of the Semi-Centennial History of West Virginia by Dr. J. Morton Callahan, being part of a special article on Water-Power Resources of West Virginia by A. H. Horton, District Engineer, Water-Resources Branch, United States Geological Survey. For stream lengths, total fall, rate of fall, etc., computed on the latest United States Geological Survey maps, see "Table of Stream Data" in this report, pages 34-37:

Indicated Horse-Power Developed by Greenbrier River.

Section of River: From	Section of River: To	Length. Mi.	Mean Drainage Area. Sq. Mi.	Minimum Discharge. Sec.-ft.	Assumed Discharge for Maximum Development. Sec.-ft.	Total Fall Feet.	Minimum Horse-power.	Assumed Maximum Development. Horse-power.	Horse-power available from storage for 12 months.	6 months.	3 months.
Source	Below East Fork	18	a130	21	53	1,000	483	1,220	......	......	......
Below East Fork	Above North Fork	13	148	25	60	260	598	1,430	......	......	......
Below North Fork	Above Knapp Creek	21	326	54	132	c310	1,540	3,760	7,540	15,100	30,200
Below Knapp Creek	Above Anthony Creek	40	670	87	271	b300	2,400	7,840	6,820	13,600	27,200
Below Anthony Creek	Above Second Creek	23	1,100	122	446	b220	2,470	9,020	21,400	42,800	85,600
Below Second Creek	Above Mouth	36	1,460	133	590	260	3,180	14,100	34,400	68,800	137,600
Total		151	......	......	......	2,350	10,671	37,010	70,160	140,300	280,600

a. Total area. b. Fall reduced to 145 ft. by proposed Lewisburg reservoir. c. Fall reduced to 160 ft. by proposed Pocahontas reservoir.

Indicated Horse-Power Developed by Tributaries of Greenbrier River.

Stream	From	To	Length. Mi.	Drainage Area at Mouth. Sq. Mi.	Minimum Discharge. Sec.-ft.	Assumed Discharge for Maximum Development. Sec.-ft.	Total Fall. Feet.	Minimum Horse-power.	Assumed Maximum Development. Horse-power.
North Fork Greenbrier	Source	Mouth	15	87	14	35	1,500	483	1,210
Knapp Creek	Source	Mouth	27	121	20	49	1,300	598	1,470
Anthony Creek	Source	Mouth	25	148	25	60	1,200	690	1,660
Howard Creek	Source	Mouth	18	90	15	36	1,000	345	828
Second Creek	Source	Mouth	24	120	20	48	1,500	690	1,660
Muddy Creek	Source	Mouth	16	70	12	28	1,000	276	644
Totals								3,082	7,472

MINERAL WATERS.

GENERAL STATEMENT, MINERAL WATERS.

In Pocahontas, as in most of the counties of West Virginia lying within the limits of the folded Allegheny Mountains, there are numerous springs most of which carry sufficient minerals in solution to be classified as mineral springs. These springs occur mainly though not always in regions of outcropping limestones and are also known to occur in drilled wells, but the information on such waters is necessarily quite small, because of the fact that seldom is it necessary to go beneath the surface to locate sufficient volumes of water for local use. At Marlinton, however, in an attempt to secure sufficient pure water to supply the town several wells were drilled.

In most of the springs some form of sulphur, which often discolors basins and which has resulted in local application of many descriptive terms, is present. Associated with the sulphur various other salts, particularly those of calcium and magnesium, are found.

These waters, in the past, have been used on a relatively small scale for medicinal purposes, especially for the alleviation of bodily afflictions. The chief benefit seems to be derived, as in most springs, from the partaking internally of sufficient quantities. Other remarkable cures of skin disorders are reported from external application effected through the medium of baths.

The only report of salt manufacture from the brines of springs was that of the Lewis Salt Well which was discontinued many years ago. There are, however, at the present time several known salt licks.

MINERAL SPRINGS.

In the following table, the writer, with the assistance of Calvin Price of Marlinton, has prepared a list of the better known springs of Pocahontas County, giving the name of the spring, its owner, and geologic horizon, with certain general remarks regarding the volume. This table is far from being complete, but does include the better known and the most important ones. The table follows:

Springs in Pocahontas County.

No.	Name of Spring.	Location.	District.	Geologic Horizon.	Owner.	Remarks.
1...	Minnehaha Springs..........	Minnehaha Springs.......	Huntersville......	Marcellus-Oriskany	W. A. H. Hobbs.....	Excellent flow of water.
2...	Peter McCarty Spring........	Browns Mt., 0.7 mi. N. W. of Mt. Tabor School...	Huntersville......	Helderberg-Bossardville..	Peter McCarty.......	Excellent flow of water.
3...	S. P. Curry Spring..........	State road 3 mi. S. E. of Huntersville	Huntersville......	Helderberg-Bossardville..	S. P. Curry.........	Good flow of water.
4...	Gibson Spring..............	0.5 mi. W. of Frost.....	Huntersville......	Helderberg...........	Sherman Gibson......	Large flow.
5...	Reece Prichard Spring.......	0.8 mi. S. E. of Dunmore.	Greenbank.......	Bossardville...........	Reece Prichard.......	Excellent stream—now bottled and sold.
6...	Jacob Slaven Spring.........	1 mi. W. of Durbin.....	Greenbank.......	Basal Greenbrier Ls.....	Jacob Slaven........	Large flow.
7...	McLaughlin Spring..........	Onoto	Edray...........	Maccrady-Greenbrier Ls. Contact............	F. R. Hunter and others............	Large flow.
8...	Drennin Spring.............	0.2 mi. N. of Edray.....	Edray...........	Basal Greenbrier Ls.....	Leo Price...........	Good water.
9...	Big Spring................	Linwood	Edray...........	Greenbrier Ls.........	Eugene Gatewood.....	Good flow.
10...	Warwick Sulphur Spring.....	1 mi. S. of Onoto.......	Edray...........	Basal Greenbrier Ls....	E. R. Sharp.........	Good flow.
11...	Cochran Spring............	1½ mi. W. of Onoto....	Edray...........	Basal Greenbrier Ls....	Porter Sharp........	Good flow.
12...	Sharp Spring..............	Campbelltown	Edray...........	Basal Greenbrier Ls.....	James A. Sharp......	Supplies Campbelltown.
13...	Adam Moore Chalybeate Spring	Head of Sharp Run......	Edray...........	Maccrady Series.......	Adam Moore........	Slight flow.
14...	Cave Spring...............	McClintock Run.........	Little Levels.....	Basal Greenbrier Ls.....	Withrow McClintock..	Large flow.
15...	Blue Spring...............	Mill Point............	Little Levels.....	Basal Greenbrier Ls.....	Tom Beard.........	Large flow.
16...	Droop Mountain Spring......	E. end of Droop Mt......	Little Levels.....	Mauch Chunk Series....	J. Cutlip's Estate....	Very slight flow.

Minnehaha Springs.—Probably the best known springs in Pocahontas County are located at the village of Minnehaha Springs. These springs emerge from the ground at two or more points through the Marcellus Shale, but near the contact with the Oriskany Sandstone which is dipping rapidly to the southeast and at an elevation of 2330′ B. At the present time a summer resort is located here, called the Minnehaha Springs Inn, including a hotel, swimming pool, and various forms of recreation. According to the literature furnished by the present owner and manager, W. A. H. Hobbs, the spring flows 1,500,000 gallons per 24 hours with a temperature of 72° Fahrenheit. The swimming pool, which is of concrete construction, is constantly being filled with the overflow from the main spring. The following analysis of the water from this spring as furnished by the present manager is as follows:

Analysis by D. C. Oudshoorn, Chemist, West Virginia University.

	Parts per million.
Free Ammonia	0.03
Albuminoid Ammonia	None
Nitrogen as Nitrites	None
Nitrogen as Nitrates	Trace
Required Oxygen	0.12
Silica (SiO_2)	6.50
Calcium Carbonate ($CaCO_3$)	88.84
Magnesium Carbonate ($MgCO_3$)	22.36
Iron Oxide (Fe_2O_3)	0.02
Aluminum Oxide (Al_2O_3)	0.09
Calcium Sulphate ($CaSO_4$)	12.45
Sodium Chloride (NaCl)	19.63
Potassium Chloride (KCl)	3.09
Loss on Ignition	10.05
Total solids	163.18

It is a mineral water of very high purity. A sample of this water was taken by the writer and analyzed by B. B. Kaplan, Chemist of the Survey. On account of extensive alterations in progress at the laboratory only an abbreviated analysis could be made but the following results show the chief mineral contents:

	In grains per gallon.
Silica	0.08
Iron	Trace
Alumina	Trace
Calcium Sulphate	0.26
Calcium Carbonate	6.70
Magnesium Carbonate	4.43
Sodium Sulphate	0.58
Total solids	12.05
Loss on Ignition	1.75

Both analyses show the Minnehaha Springs to be remarkably pure. Aside from its purity or whatever medicinal qualities it may have it seems unfortunate that so fine a spring surrounded by beautiful scenery can not be utilized to more advantage than it is at present.

Peter McCarty Spring.—The Peter McCarty Spring, located on a branch of Browns Creek 0.7 mile northwest of Mt. Tabor School, is largely a calcium and magnesium carbonate water issuing near the Helderberg-Bossardville Limestone contact, the elevation of the ground being approximately 2500 feet. A very large and constant flow of sparkling clear water pours out the year round and appears to have but very slight if any change in temperature throughout the year.

Reece Prichard Spring.—The Reece Prichard Spring located along the highway (State Route No. 42) 0.8 mile southeast of Dunmore is one of the largest artesian springs in Pocahontas County, comparing favorably with the Minnehaha Springs in size. This water emerges at two or more points in the Bossardville Limestone and contains principally the minerals of calcium, magnesium, and sulphur. Very little use is being made of this excellent flow of water save during the summer months when a very small portion of its entire flow is bottled for drinking purposes. A sample of this water was taken by the writer and analysis was made in the laboratory of the Survey by B. B. Kaplan, Chemist, as follows:

	In grains per gallon.
Calcium Sulphate	1.95
Calcium Carbonate	3.30
Magnesium Carbonate	1.21
Sulphur Trioxide	2.82
Total solids	9.28
Loss on Ignition	3.85

Droop Mountain Spring.—The Droop Mountain Spring is located on the eastern end of Droop Mountain and emerges from the Hinton Group of the Mauch Chunk Series, being a spring with a very small flow. Remarkable cures by persons who have used this water for internal disorders have been reported. A sample of this water was taken by Calvin Price and Edward Moore of Marlinton and analyzed in the Survey Laboratory by B. B. Kaplan, Chemist, as follows:

	In grains per gallon.
Silica	0.08
Iron and Alumina	0.029
Calcium Sulphate	1.25
Calcium Carbonate	3.1
Magnesium Carbonate	3.2
Total solids	7.6
Loss on Ignition	1.1

Other Springs.—Other than the above described springs there are many more that deserve to be mentioned, some of them being included under the Table of Pocahontas County Springs. The most of these are from the base of the Greenbrier Limestone, and the most important are the McLaughlin, Drennin, Big, Sharp, Cave, and Blue Springs. These springs, however, often follow large fissures in the limestone and many of them have direct surface tributaries so that their volume as well as their quality is quite variable. The Chalybeate Springs, which in this area are generally found in the red shales, are of small volume.

Salt Sulphur Well.—According to information furnished by John Alexander of Marlinton, water wells drilled just east of the present tannery contained a relatively high mineral content especially of sodium chloride. An analysis of this water furnished by Mr. Alexander was as follows:

Analysis of Salt Sulphur Well at Marlinton by Froehling and Robertson, Chemists, of Richmond, Virginia:

	Grains per Gallon.
Calcium Bicarbonate	14.408
Magnesium Bicarbonate	1.703
Iron (ferrous) Bicarbonate	1.096
Calcium Chloride	75.967
Magnesium Chloride	17.727
Potassium Chloride	0.875

	Grains per Gallon.
Lithium Chloride	1.808
Sodium Chloride	871.000
Ammonium Chloride	Trace
Sodium Sulphate	3.212
Potassium Iodide	0.192
Potassium Bromide	6.952
Calcium Phosphate	Trace
Silica	9.33
Alumina	1.45
Total	999.018
Dissolved gases:	
Free Carbon Dioxide	1.51 cubic inches.
Free Sulphuretted Hydrogen	1.60 cubic inches.

The foregoing well was found to be so potent with mineral salts and natural gas that it was unsatisfactory for domestic purposes.

Town Water-Supply Well.—This well was drilled only fifteen feet east of the Salt Sulphur Well. A strong flow of water was encountered at 100 feet and supplied the town of Marlinton until 1925. It had a daily capacity of 100,000 gallons. An analysis of this water was also furnished by Mr. Alexander as prepared by Froehling and Robertson, Chemists, of Richmond, Virginia, as follows:

	Grains per Gallon.
Calcium Bicarbonate	1.83
Magnesium Bicarbonate	0.69
Iron (ferrous) Bicarbonate	0.53
Sodium Bicarbonate	9.95
Sodium Chloride	11.78
Sodium Sulphate	3.37
Potassium Sulphate	0.45
Silica	0.87
Alumina	Trace
Total solids	29.47

"The analysis shows that this is a Bicarbonate of Soda and Chloride of Sodium Water containing only a very small amount of lime and magnesia."

IRON ORE.

GENERAL STATEMENT, IRON ORE.

The principal prospecting horizons for iron ore in Pocahontas County are the Oriskany and Clinton, the former being of Devonian age and containing brown hematite (limonite) while the latter is of Silurian age and contains red hematite. In the Mississippian Period vast quantities of iron are disseminated through the red Mauch Chunk shales but not sufficiently concentrated to be of economic value by the present known methods of extraction. In the Pennsylvanian are often found numerous nodules of iron carbonate but their presence is generally too infrequent to be of value.

The Oriskany and Clinton ores are confined entirely to the Beaver Lick-Browns-Michael Mountain area.

During the latter half of the nineteenth century and the early part of the present century great interest was taken in the West Virginia iron ores but at the present this interest lies practically dormant, due to the discovery and operation of vast quantities of a more accessible and purer grade ore in the Great Lakes region.

ORISKANY IRON ORE PROSPECTS AND EXPOSURES.

About the year 1900 a considerable amount of prospecting was done along Beaver Lick Mountain in Greenbrier and Pocahontas Counties, which included trenching and pits across the strike of the rocks. In 1907 and 1908 further prospecting was done under the direction of Mr. John Fulton, a mining geologist, of Johnstown, Pennsylvania. At the present time little evidence is seen where the prospecting was done, but fortunately valuable information about this area was given to Dr. G. P. Grimsley and published in Volume IV of the West Virginia Geological Survey Reports. That information which pertains to Pocahontas County will be included on subsequent pages of this report.

Oriskany Ore.

The Oriskany Sandstone, which is now found in Pocahontas County standing with steep dips, often carries deposits of limonite ore. These ores are generally considered as replacement, rather than original, from the Helderberg and adjacent beds of the Oriskany. Nodules of this ore are now found along the outcrop of this horizon. Because of the fact that there are now no fresh exposures it is necessary to republish the information as furnished by Mr. John Fulton and published in Volume IV of the Survey Reports. Data on these prospects and exposures that lie in Pocahontas County are as follows:[1]

"**Perry Prospect.**—(Just north of Greenbrier-Pocahontas County line on the east side of Beaver Lick Mountain.—P. H. P.) Approximately 450 feet above the North Fork of Anthony Creek and a mile and a quarter distant, the ore has been opened in a large cut 70 feet wide and 15 to 25 feet deep showing 50 feet of ore. The foot-wall is the brownish Oriskany Sandstone which dips 36 to 40 degrees in direction N. 50° E., while on the hill above the ore are limestone and flint fragments.

"The ore is very porous and almost steel gray in color, but weathers to a red soft ore on the surface. It is free from sand and clay and appears to be of good quality. The boulders of ore are found especially abundant at a point 180 feet lower in a ravine indicating the possibility of a very large ore body in this hill. The composition of the ore according to the Lehman, Fulton, and Survey analyses is given below".

	Lehman Report. Per cent.	Fulton Report. Per cent.	Survey Report. Per cent.
Metallic Iron	**53.31**	**53.20**	**59.23**
Moisture	.....	.....	0.23
Loss on Ignition	.....	7.22	5.02
Silica	7.60	13.50	7.24
Iron Oxide	.....	.....	84.67
Lime Oxide	.....	.....	0.24
Manganese Dioxide	.....	0.18	0.02
Sulphur	.....	.....	0.22
Phosphorus	.....	.....	0.19
Titanium Oxide	.....	...	0.07

"**Dan Prospect.**—The Dan opening is located 1¾ miles northeast of the Perry and one and a half miles west of the railroad and 325 feet higher. A large open cut or trench gives a section of the ore body. In some former prospect work, four tunnels were driven in this trench to intersect the ore body. The top tunnel is 15 feet above the second which is 20 feet above the third, and the fourth is 45 feet lower.

"The two upper tunnels were about the level of the ore body but were driven in the wrong direction. The two lower tunnels were made below the ore body in the foot-wall. The bottom tunnel was 380 feet long and runs in a N. 30° W. direction and no ore appears in its walls. A considerable quantity of ore was blasted from the ore body in the open cut, but the tunnel work was apparently a failure.

"The foot-wall of the ore body is a yellowish sandstone weathering to sand, and the ore is mixed with it in a nodular form in its upper portion. This sandstone, which is the Oriskany, trends N. 30° E. with a dip of 30 degrees in a direction S. 50° E. The ore body shows in this opening with a thickness of 40 feet. It is dark brown in color, compact in texture except for scattered small pores. Its composition is shown by the following analyses:

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[1]G. P. Grimsley, Vol. IV, W. Va. Geol. Sur., pp. 270-272; 1909.

	Lehman Report. Per cent.	Fulton Report. Per cent.	Survey Report. Per cent.
Metallic Iron	49.25	50.60	58.93
Moisture	.....	.....	0.19
Loss on Ignition	.....	.....	11.26
Silica	8.90	13.41	2.01
Iron Oxide	.....	.....	84.21
Lime Oxide	.....	.....	0.20
Manganese Dioxide	.....	0.11	0.02
Sulphur	.....	.....	0.02
Phosphorus	0.336	0.402	0.72
Titanium Oxide	.....	.....	0.07

"**Monument Prospect.**—The Monument openings were made three-fourths mile northwest of Dan and one mile west of the railroad at Mr. Wade's house, and 390 feet above the railroad. A large open cut was made into the ore at this place on the side of one of the foot ridges of the main mountain. The ore was found in a large body in place and 20 feet in thickness. The foot-wall is a brown sandstone trending N. 30° E., with a dip of 40 degrees in a direction S. 50° E.

"The ore is a dark-brown hematite, compact in texture with an uneven fracture and contains black streaks irregularly distributed through it. The ore has been exposed in pits up this ridge to a height of 45 feet above the open cut. Sixty feet lower and 10 feet above the bottom of the small ravine, a tunnel was driven 100 feet in a direction N. 60° E., to intersect the ore body but at this distance did not strike the ore except in form of a few scattered boulders.

"The following analyses of the ores in the open cut of Monument prospect were made for the Lehman and Fulton reports, and by the Survey of an average lot of the ore:

	Lehman Report. Per cent.	Fulton Report. Per cent.	Survey Report. Per cent.
Metallic Iron	45.34	37.10	36.77
Moisture	.....	.....	0.10
Loss on Ignition	.....	.....	5.92
Silica	21.50	34.81	37.26
Iron Oxide	.....	.....	52.54
Lime Oxide	.....	.....	0.22
Manganese Dioxide	.....	0.07	0.02
Sulphur	.....	.....	0.02
Phosphorus	.....	.....	0.92
Titanium Oxide	.....	.....	0.07

Although thorough prospecting was not continued farther to the north along the Oriskany outcrop, nor on the west slope of Beaver Lick-Browns-Michael Mountain, along which the Oriskany Sandstone has similar exposures, these areas would quite likely produce the same ore in like quantities and character.

CLINTON ORES.

The Clinton Iron Ore can be roughly classed under two headings as: Clinton Fossil Ore and Iron Sandstone, neither of which is of great economic value in Pocahontas County but which are of considerable scientific interest. The former is considered by some geologists as representing iron that has replaced a limestone and often contains numerous fossil shells and oolitic concretions. One of the arguments advanced for the support of this theory is the transition of the Fossil Ore to limestone below certain depths. The Iron Sandstone is generally considered as containing iron of primary origin, that is, deposited at the same time as the sand comprising the matrix. This sandstone, while attaining a thickness of 70 feet at certain points along Beaver Lick-Browns-Michael Mountains and having a bright-red color, contains only a small percentage of metallic iron and has a high percentage of silica.

Two samples of the Iron Sandstone were collected, both of which appeared to be highly impregnated with iron. The analyses of these samples by Dr. B. B. Kaplan, Survey Chemist, follow:

Clinton Iron Sandstone.—West side of Beaver Lick Mountain, two miles southwest of White Rocks. Thickness, 50 to 75 feet exposed.

	Per cent.
Silica (SiO_2)	74.08
Ferric Iron (Fe_2O_3)	19.10
Alumina (Al_2O_3)	5.20
Loss on Ignition	1.30
Total	99.68

Clinton Iron Sandstone.—Along Knapp Creek, one-half mile southeast of Buzzard Hollow.

	Per cent.
Silica (SiO_2)	89.76
Ferric Iron (Fe_2O_3)	7.22
Alumina (Al_2O_3)	2.03
Loss on Ignition	0.92
Total	99.93

It is possible that these two samples do not represent the maximum amount of iron present in the Iron Sandstone but they indicate that this horizon offers little inducement as a source for large quantities of iron.

Fossil Ore.—The Fossil Ore horizon while containing a much higher percentage of ferric iron is generally quite too thin to be mined. Furthermore the beds are dipping at such steep slopes as to lessen greatly the amount that could otherwise be recovered. Few exposures of this ore were available but those seen were measured in inches rather than feet. A sample of Fossil Ore was collected along Knapp Creek, one-half mile southeast of Huntersville. The analysis by Dr. B. B. Kaplan, Survey Chemist, follows:

	Per cent.
Metallic Iron (Fe)	39.07
Silica (SiO_2)	15.18
Ferric Iron (Fe_2O_3)	55.86
Alumina (Al_2O_3)	9.13
Calcium Carbonate ($CaCO_3$)	9.49
Magnesium Carbonate ($MgCO_3$)	2.22
Phosphoric Acid (P_2O_5)	3.63
Loss on Ignition	4.56
Total	100.07

It seems to the writer that the Clinton ores offer the best localities for prospecting in Pocahontas County in those areas where this formation is pocketed or included in a basin between steeply inclined folds. Such localities are to be found between the sharp folds of Beaver Lick, Browns, and Michael Mountains. Here these basins have accumulated secondary deposits of iron, leached from the associated rocks and particularly the Clinton itself, so that large lenses of comparatively good ore might now be found. The prospecting of such areas would require a great deal of work including several trenches or pits to get below the present talus.

SUMMARY OF IRON ORE.

In view of the limited information at hand the writer considers it inadvisable to attempt to calculate the available iron ore reserve for Pocahontas County. In those areas where surface thicknesses have been measured showing an appreciable deposit of ore, particularly the Oriskany, inclined shafting at comparatively shallow depths would be possible but the ore was found only in scattered nodules. If, in the case of both the Oriskany and Clinton, the ores are limestone replacements, as is generally believed, the depths at which the lime content reduces the iron content to negligible quantities are also quite uncertain.

Suffice it is to say that both the Oriskany and Clinton ores contain sufficient quantities of iron as to be of economic value in the future. Until, however, far more careful and detailed prospecting has been done, the amount of available ore can not be determined.

MANGANESE.

GENERAL STATEMENT.

Manganese in varying proportions is found in Pocahontas County in close association with the iron ores of the Oriskany and Clinton Series. Because of this known association iron oxide which at times assumes the botryoidal structure of psilomelane is often mistaken for the latter. A simple way, however, to distinguish the manganese oxides from the iron oxides in the field is to scratch a piece of white quartz or quartzite with the mineral to determine its color or streak. If manganese, it will leave a very dark-brown or black streak, while the iron oxide in the form of hematite leaves a reddish-brown streak, and limonite leaves a yellowish-brown streak. Iron ore containing some manganese leaves a brownish-black streak. In this latter connection manganese, which seldom exceeds one per cent., is generally known in Pocahontas County. The occurrence, however, of loose pieces of psilomelane ore containing as much as 40 per cent. metallic manganese found on Michael Mountain would indicate that larger deposits might be found at their sources.

It is the contention of Stose and Miser,[2] who have made a detailed study of the manganese deposits of the adjoining territory of Virginia, that the accumulation of workable deposits is believed to have occurred at times when parts of the land surface were reduced to peneplains, when the streams were nearly level and were sluggish with slight run-off, so that debris from the weathering and disintegration of the rocks at the surface accumulated to great thickness. Under these conditions the iron and manganese were taken into solution and carried downward to the bottom of the weathered zone and there redeposited in the interstices of the rock.

[2]G. W. Stose and H. D. Miser, Manganese Deposits of Western Virginia, Bull. XXIII, Va. Geol. Sur., pp. 52-55; 1922.

The present known occurrence of manganese ores in particular formations leads to the supposition that it was probably originally deposited in greater quantities in certain beds than in others, that it did not necessarily form bodies of ore in the original deposition but was disseminated in small quantities through the beds, and that later circulating ground waters dissolved it at one point and redeposited it in the same or adjacent beds in concentrated form.

MANGANESE PROSPECTS.

Very little prospecting for manganese has been done and so far as known no commercial quantities of this ore exist in Pocahontas County. A more thorough search, however, should be made along the Oriskany-Helderberg and lower Clinton Series. On the southern end of Michael Mountain loose pieces of what appeared to be manganese (psilomelane) ore are scattered over the fields. Two representative pieces were collected for analysis, one of which was determined to be a very good manganese ore while the other contained no manganese but was a good iron ore. The analysis of the manganese ore follows:

Loose piece of **psilomelane** found on south end of Michael Mountain 1.5 miles west of Cove Hill School; analyzed by Dr. B. B. Kaplan, Survey Chemist.

	Per cent.
Metallic Manganese (Mn)	40.70
Silica (SiO_2)	10.70
Ferric Iron (Fe_2O_3)	3.41
Manganese Dioxide (MnO_2)	64.40
Lime (CaO)	None
Potash (K_2O)	1.20
Phosphoric Acid (P_2O_5)	Trace
Moisture	0.26
Barium Oxide	12.64
Sulphur	0.16
Loss on Ignition	7.08
Total	99.85

"This sample represents a good grade of manganese ore. An ore of this type sells for approximately 40 cents per long ton unit of manganese at seaport. It would therefore be worth about $16.00 per ton at seaport. Whether it will be practical to mine this ore will therefore depend entirely upon the quantity available."

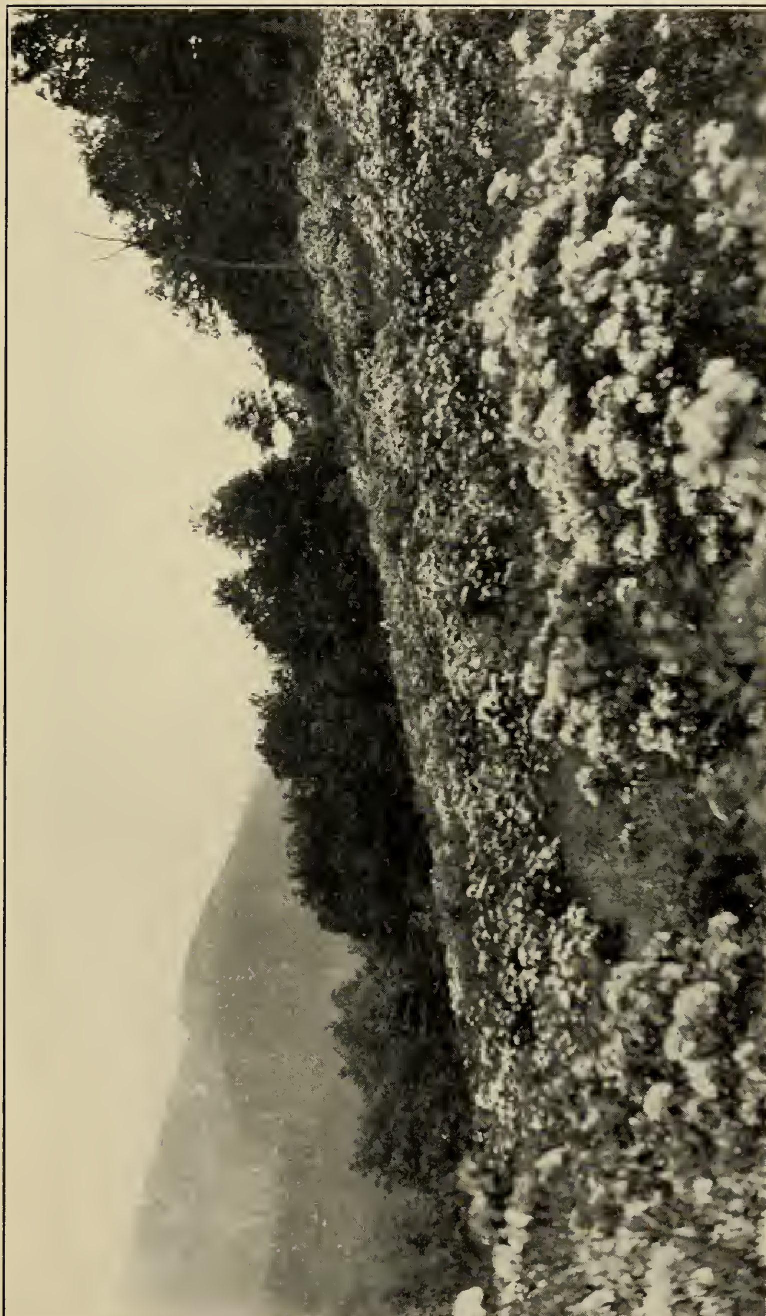

PLATE LI.—Mountain Laurel **(Kalmia latifolia)**. A common scene in Pocahontas County. Many car-loads of this shrubbery are collected annually and shipped to eastern nurseries. (Photo. by Paul H. Price).

PLATE LII.—Burned-over area north of Durbin. It is in this area that the Monongahela National Forest is attempting to reforest. (Photo. by Paul H. Price).

PLATE LIII.—Droop Sandstone of Mauch Chunk Series on West side of Droop Mountain. Here it is fractured and broken, making suitable material for a road base for which it is being used. (Photo. by Paul H. Price).

PLATE LIV.—Limestone Quarry in Sinks Grove member of Greenbrier Series, operated by State Road Commission, on farm of Fred Ruckman along Seneca Trail (State route 24) at head of Stevens Hole Run, ¾ mile northeast of Mill Point. Note Greenbrier Series topography. (Photo. by Paul H. Price).

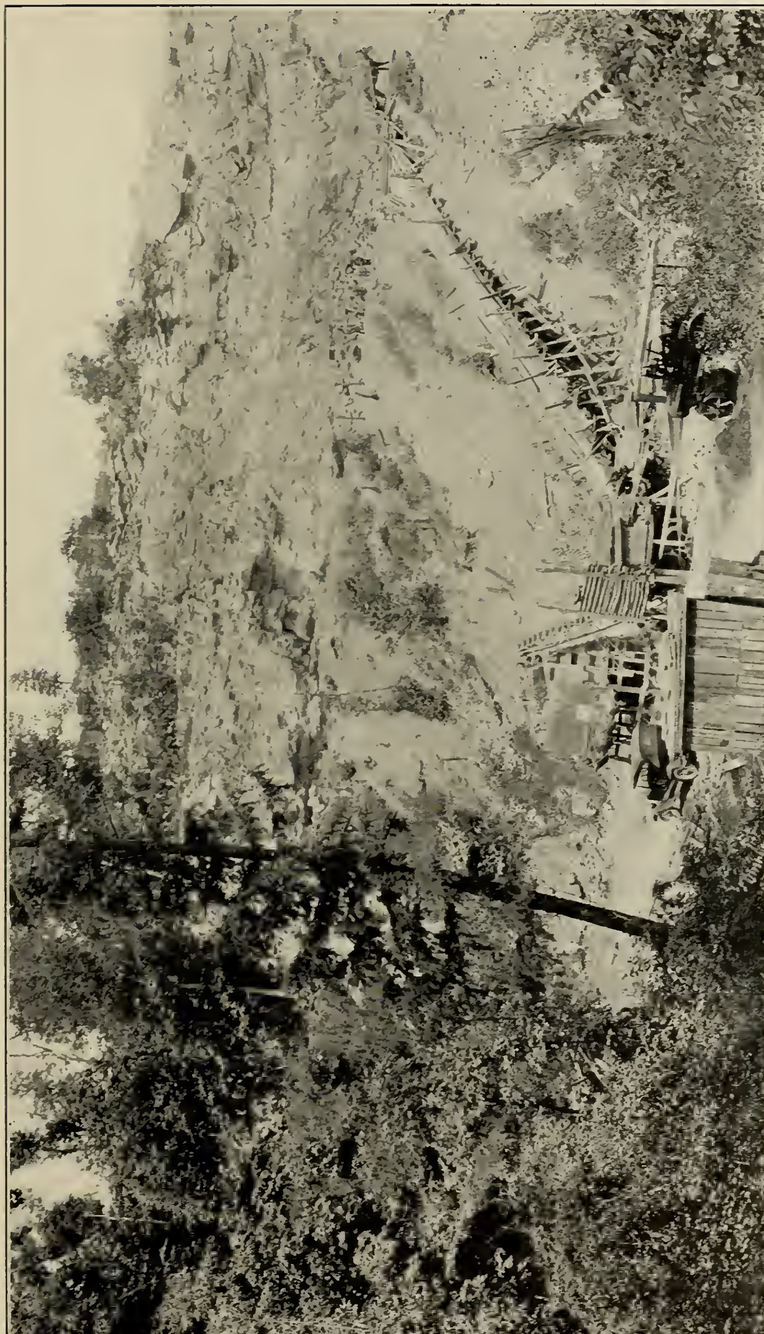

PLATE LV.—Limestone Quarry in Sinks Grove member of Greenbrier Series, operated by State Road Commission, on farm of Fred Ruckman ¾ mile north-east of Mill Point. (Photo. by Paul H. Price).

PLATE LVI.—Huntersvile Chert Beds (Oriskany) from the Sherman Gibson farm at Frost, used to surface State route 42 between Green Bank and Marlinton. (Photo. by Paul H. Price).

PLATE LVII.—Huntersville Chert Beds (Oriskany), on farm of Howard Barlow at Huntersville. Used in surfacing State route 42 between Marlinton and Green Bank. (Photo. by Paul H. Price).

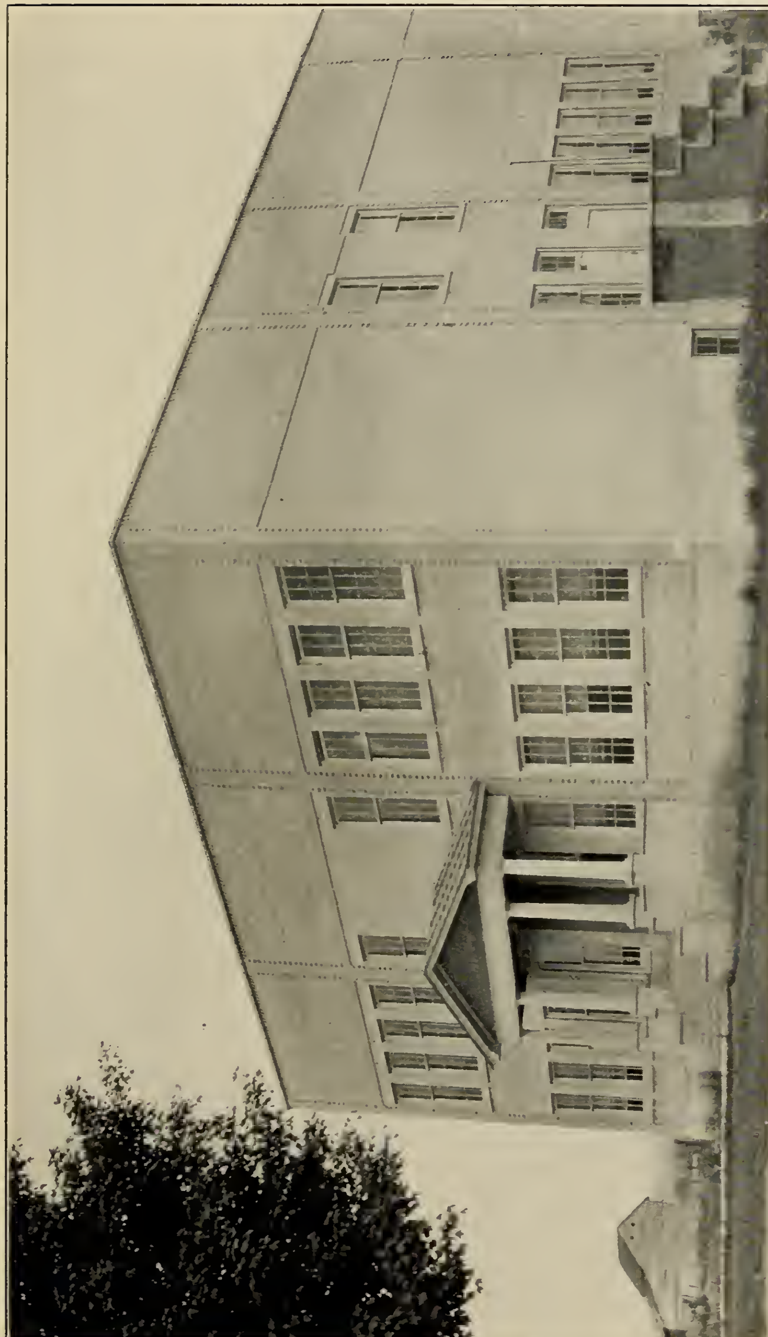

PLATE LVIII.—Hillsboro School made from lime brick, quarried from local quarry in Greenbrier Limestone. (Photo. by Paul H. Price).

PRECIOUS METALS.

It was said long ago that an investigator who makes an adverse report upon a given region should be prepared to be as ill received as a physician who informs a patient that there is no hope of recovery.

A thorough investigation, however, of the stratigraphy and structure of the rocks of Pocahontas County leads the experienced geologist or engineer to the conclusion that the precious metals like gold, silver, copper, and lead will not be found save in small quantities, if at all. There exists, however, in practically every county of the State a belief that there is an abundance of these minerals hidden in some secure place, the exact location of which was known only by a man who is now gone, the report having been handed down from generation to generation. Credence in such beliefs is more prevalent in the more mountainous sections, the argument being offered that lands which do not contain coal and which are too rough for cultivation must have gold or other precious metals to preserve the general balance in nature.

It is a safe assumption, however, that the surface rocks of Pocahontas County, which are sedimentary, that is, deposited in or by water, will not contain precious metals in appreciable quantities. No trace of igneous or quartzite intrusions, with which these metals are commonly associated, are known to occur in this area; neither are plugs or dikes known to occur, while almost the only quartz is that which is contained in the pebbles of the conglomeratic sandstones which were derived from the erosion of an ancient mountain mass located along what is now the Atlantic Coast. It is quite possible these ancient mountains, from which these sediments were derived, contained appreciable amounts of the precious metals, but in the process of erosion, transportation, and redeposition the ores have been so scattered that the present rocks contain only traces of their former localized accumulations.

TRACES OF ORE.

In Edray District in the general vicinity of Onoto numerous reports regarding the presence of gold in an argillaceous limestone, which corresponds to the Glenray or Reynolds horizon, were prevalent. Some of the ore is said to have been assayed in Washington and had a value of 15 dollars per ton. A sample of this material, handed to the writer, revealed small mica flakes and iron pyrites. As already stated in the foregoing discussion, gold in appreciable quantities will not be found in such sediments.

Stony Bottom Prospect.—Some years ago a shaft was sunk near Stony Bottom in the hope of locating gold-bearing rock. Unfortunately at the time of the writer's visit this opening had fallen partly shut so that the bed-rock could not be seen. The surface horizon is in the Catskill Series. A sample of the rock reported to have been taken from this prospect showed traces of copper. The matrix of this small single specimen was composed of quartz and was traversed by minor fissures, and had the appearance of a true quartz vein. It is quite unlikely that any of the precious metals will be found in the Catskill rocks. If, however, there should prove to be a concealed dike or vein, only further prospecting would reveal its economic value.

CHAPTER XIV.

LIMESTONE, CLAY, BUILDING STONE, ROAD MATERIAL, GLASS-SAND, AND FORESTS.

LIMESTONE.

GENERAL STATEMENT.

From an economic viewpoint the limestone of Pocahontas County stands out as a most important asset. Next to the timber which has been the greatest source of revenue, but which is at present rapidly declining, limestone is the most valuable natural commodity that the county can now offer to outside markets. The original source of wealth in order of importance was timber, limestone, agricultural soils, coal, mineral springs, water-power, and iron ore; of these the timber has been mostly removed and reforestation will be slow. Agriculture can be extensively developed only in the more favored localities. The coals, because of their location and character, will afford no immediate revenue. The original wealth of limestone, however, remains practically untouched. The same condition is true regarding the iron ore except that the importance of this mineral has been greatly lessened by the discovery and operation of the larger and better Great Lakes deposits. The mineral springs, situated as they are among beautiful scenery as well as a healthful and invigorating climate, deserve more attention than they have received in the past. It has already been pointed out that the advantage derived from water-power would be largely offset by the disadvantage brought about by its development.

It is therefore apparent that limestone is the most hopeful mineral or natural commodity. The deposits are located in close proximity to the railroad so that they may be easily reached by lateral spurs. The quality of the various limestones shows them to be suitable for Portland cement, agricultural and building lime, railroad ballast, road material, concrete aggregate, and numerous other uses, such as blast-furnace flux, paper, glass, leather, etc. In quantity the supply might be roughly spoken of as unlimited. The Greenbrier Limestone itself, with an average thickness of 400 feet, extends the entire length of the county, approximately 57 miles.

The commercially important limestones are those of the Greenbrier Series of Mississippian age and the Salina Series of Silurian age, the outcrops of which are shown on Figures 7 and 13, respectively.

The local use of limestone in the county has been largely confined to road material, agricultural lime, concrete aggregate, and at Hillsboro for the manufacture of a lime brick. So far as known no attempt has been made to build masonry structures of limestone, in spite of the fact that certain portions of the Greenbrier Limestone in the vicinity of Hillsboro are admirably suited to this purpose, having a pleasing color, oolitic structure and being susceptible to polish. This phase will be discussed further under Building Stones.

LIMESTONES OF THE MISSISSIPPIAN PERIOD.

In the Mississippian Period there are numerous limestones of variable quality and thickness. In the Mauch Chunk Series, the Reynolds and Glenray are generally too thin, impure, and siliceous to be of importance except as soil producers. The Greenbrier Series is composed largely of limestone of a very good grade. In the Maccrady Series the limestone is thin and quite impure, containing a high percentage of magnesium carbonate. In the Pocono Series limestone is entirely absent except for concentrated shell deposits that contain an appreciable amount of lime. The following table indicates, in descending stratigraphic order, the calcareous beds of the period that deserve economic discussion:

Mauch Chunk Series—Bluefield Group:
- Reynolds
- Glenray

Greenbrier Series:
- Alderson
- Union
- Pickaway
- Taggard
- Patton
- Sinks Grove
- Hillsdale.

LIMESTONES OF THE MAUCH CHUNK SERIES.

Reynolds Limestone.

The **Reynolds Limestone** of the Bluefield Group, described on pages 158-160, is a gray to light-blue deposit, quite shaly at the top but becoming more massive at the base and varying in thickness from 15 to 30 feet, (See Plates XXIV and XXV). The present value of this limestone is that in weathering it adds lime to the otherwise poor Mauch Chunk soil and makes an excellent grazing land. This bed is generally too thin and impure to be used independently, but if quarried with its overlying shale, it could be used as a mixing agent to reduce the high lime content of some of the pure beds of the underlying Greenbrier Series in the manufacture of Portland cement. Outcrops of the Reynolds Limestone are many and can be found near the contact of the Greenbrier and Mauch Chunk Series.

Glenray Limestone.

The **Glenray Limestone** of the Bluefield Group, described on pages 162-163, is a limestone of varying purity, being often quite siliceous and interbedded with sandy shales. This limestone is not well developed in Pocahontas County and because of its apparently small importance its chemical qualities were not determined. Its outcrops have been described in the above reference.

LIMESTONES OF THE GREENBRIER SERIES.

The **Greenbrier Series**, varying in thickness from 320 to 600 feet and composed almost entirely of limestones the individual characteristics of which are somewhat different, offers numerous opportunities for commercial exploitation. As shown by Figure 7 and in more detail by Map II there is a vast area of this series. In Chapter VIII attention has been called to the difference in physical features of the respective members of this series, and to the fact that it is often possible to recognize them at widely scattered points by means of their lithology.

In chemical composition the limestones of this series vary from 1 to 15 per cent. in silica, from 45 to 97 per cent. in calcium carbonate, while the magnesium carbonate is generally less than three per cent., although occasionally much higher. It can therefore be seen that these limestones might be used for numerous purposes where calcareous material is desired. Many of the analyses in particular fall within the range required for the manufacture of Portland cement where a calcium carbonate content of approximately 75 per cent. and a magnesium carbonate content of less than five per cent. is required. From an examination of the table of limestone analyses it can be seen that there are some localities where certain members of the Greenbrier Series are suited for Portland cement without the admixture of other material. At other points it would be necessary to add certain quantities of shale to lessen the lime content, but this material is readily available just above the limestone in the basal Mauch Chunk Series.

The Chesapeake and Ohio Railway roughly parallels the outcrop of these deposits and there is ample water and labor supply, while vast quantities of high-volatile coal are available in counties lying to the north and west. With such favorable factors it would appear that the development of these deposits will not long be overlooked.

Alderson Limestone.

The **Alderson Limestone**, coming at the top of the Greenbrier Series and already described on page 176, is a dark-gray, hard, siliceous deposit and contains alternating beds of pure and granular limestone and some shaly and calcareous zones, with a thickness varying from 50 to 75 feet. Although no samples were taken for analysis it is believed to be generally too siliceous for independent use, but could possibly be used advantageously with the underlying pure Union Limestone for the manufacture of Portland cement. The more massive and resistant beds could also be used where a hard, durable limestone is needed, as in road base, concrete aggregate, ballast, etc.

Union Limestone.

The **Union Limestone,** previously described on pages 177-178, is a massive, pure, hard limestone, easily recognized by grayish-white color in contrast with the darker beds above and below it. It is quite often oolitic and contains numerous **Pentremites.** In the vicinity of Hillsboro this member varies in color from dark-gray to pink and maroon, giving it a pleasing color. It varies in thickness from 70 to 100 feet and because of its generally high lime content offers many possibilities for commercial exploitation. Sixteen samples of this limestone were collected at various localities over the county, nearly all of which contained more than 90 per cent. calcium carbonate. The analyses of the limestones along with their location are included at the end of this discussion under the table of limestone analyses.

Pickaway Limestone.

The **Pickaway Limestone,** already described on pages 178-179, is a dark, hard stratum usually containing some silica. At some points, however, it is relatively pure. Because of this variation in calcium carbonate content its use for lime purposes is quite uncertain, but because of its hard and durable character it could be used to good advantage for road material, concrete aggregate, railroad ballast, etc. The analyses of the three samples of this member which appear in the table of limestone analyses all show a good grade of limestone. These will probably be higher in calcium carbonate than the general average because of the fact that the samples were taken where the prospects appeared most hopeful.

Taggard Limestone.

The **Taggard Limestone,** previously described on page 179, is a ledge of light-gray to whitish oolite, varying from 5 to 10 feet in thickness and coming near the middle of the Greenbrier Series and marked by beds of red shale above and below it. This ledge has suitable qualities for a building stone, but because of its small thickness and general overburden of other sediments can not be profitably quarried in competition with the more abundant similar deposits of the Mississippi Valley. Its outcrops have been more fully described in the above reference.

Patton Limestone.

The **Patton Limestone,** previously described on pages 179-180, resembles the Union Limestone in many respects and might be mistaken for it where the complete section is not available. It is a heavy and usually massive bed but shaly at the top with a hard bluish-gray zone at the base and varies in thickness from 100 to 150 feet. It also contains a zone of oolite and occasionally nodules of black chert.

Chemically, the Patton Limestone is quite pure. Three samples of this member were collected, the analyses of which with their locations appear at the end of this discussion under the table of limestone analyses.

Sinks Grove Limestone.

The **Sinks Grove Limestone,** as previously described on page 181, is a massive, blue, hard, somewhat sandy and impure deposit that weathers yellow at the top and dark-gray at the base and often contains nodules of black chert. The chert is very resistant, being often found near the outcrop and having been highly prized by the Indians for making artifacts. In thickness this limestone varies from 50 to 75 feet (See Plate LIV). It can usually be distinguished from the overlying Patton Limestone by its generally darker character and greater amount of black chert. It also contains streaks of highly siliceous material. Because of this lack of uniformity in character along with the objectionable chert, its use as a source of lime is quite uncertain, but it is admirably adapted at some localities for the various grades of crushed limestone where a hard and durable character is required.

Hillsdale Limestone.

The **Hillsdale Limestone,** previously described on pages 181-182, is the basal member of the Greenbrier Series, being usually gray to dark and massive and containing numerous nodules of gray to black chert. (See Plates XXVII and XXVIII). In thickness it varies from 50 to 75 feet. From this member the large quantities of corals now found strewn over the fields have been dissolved. Owing to the large amount of chert its use as a source of lime is limited but for concrete aggregate and road material it is especially well adapted and has been used for this purpose quite extensively in Pocahontas County.

In the following table of limestone quarries four were operating from the Hillsdale member:

Limestone Quarries, Pocahontas County.

No. on Map II.	Geologic Horizon.	Operator.	Location.	Property Owner.
1	Sinks Grove and Hillsdale......	State Road Commission..	0.8 mile northeast of Mill Point at head of Stevens Hole Run............	Fred Ruckman
2	Hillsdale.......	Pocahontas County.....	On Swago Creek one-fourth mile northwest of Dry Creek School......	Withrow McClintock
3	Hillsdale.......	Pocahontas County.....	0.3 mile north of Edray.	Pocahontas County
4	Basal Greenbrier.	Pocahontas County.....	1.6 miles south of Hillsboro and 0.5 mile west of Burnsides..........	Joel Beard
5	Hillsdale.......	Pocahontas County.....	1.5 miles west of Onoto...	Porter Sharp

LIMESTONES OF THE DEVONIAN AND SILURIAN PERIODS.

General Statement.

The older limestones of Pocahontas County, including the basal Devonian and Silurian limestones, are of less extent than those of the Mississippian but of considerable local importance. These lie entirely east of the Greenbrier River and may be seen along the Beaver Lick-Browns-Michael Mountain area, their exposure being due to erosion along the Browns Mountain Anticline.

In the Devonian Period the thin Lower Selinsgrove Limestone occurs near the base of the Marcellus Series, and the Helderberg Series, marking the lowest formation of the Devonian, is composed largely of siliceous limestone. In the Silurian Period large deposits of high-grade limestone comprise the upper portion, including the Salina Series. Because of the general inaccessibility of these beds their importance as a commercial product is less than that of the Greenbrier Limestone of the Mississippian Period, but of considerable importance locally to add lime to the soil and as a source of lime for local burning for agricultural purposes. Furthermore they may be used advantageously as crushed limestone for road building purposes. The following limestones of the Devonian and Silurian Periods, in descending stratigraphic order, are deserving of economic discussion:

Devonian Period:
Marcellus Series
Lower Selinsgrove

Silurian Period:
Salina Series
Niagara Series.

Lower Selinsgrove Limestone.

The **Lower Selinsgrove Limestone,** previously described under the discussion of the Marcellus Series, is composed of thin, siliceous limestone alternating with black, carbonaceous shale. This limestone is too thin and generally impure to be of economic importance, its chief value being as a source of lime for the soils.

Helderberg Limestone.

The **Helderberg Limestone,** previously described on pages 239-243, is generally a bluish-gray to dark massive deposit, occasionally crystalline or quite pure but often highly siliceous and at times quite argillaceous or shaly. Its thickness varies from 150 to 300 feet. This limestone might be used for concrete aggregate or road material but its high silica content and general cobbly nature would apparently preclude its successful use in the manufacture of cement or lime.

Salina Series.

The **Salina Series,** composed of the Bossardville and Rondout Groups, with their outcrops indicated on Figure 13, page 248, and previously described on pages 245-251, contains large quantities of a very good grade of limestone. The Bossardville is made up of thin beds of light-gray deposits, usually laminated but occasionally massive in part, while the Rondout is generally more massive, of a darker color and of a higher silica content. The latter, upon weathering, has the appearance of sandstone. The Bossardville Limestone invariably contains a high calcium carbonate content and makes an excellent lime for burning while the Rondout is often of the proper proportions for natural cement, having been used for that purpose at Cedar Cliff, Mineral County, West Virginia, and at various other points in Maryland and New York. The Bossardville and Rondout Limestones combined attain a thickness of 600 feet and extend the entire length of Michael, Browns, and Beaver Lick Mountains in Pocahontas County, their thickness often being repeated by folding, so that a large quantity of the material is available.

Niagara Series.

The **Niagara Limestone,** previously described on pages 251-254, is of little importance in Pocahontas County being limited to thin, but often quite pure beds, associated with calcareous shales and being only a minor part of its northeastern equivalent. Its chief value is as a fertilizer to the land upon which it outcrops, and it may occasionally furnish beds of sufficient thickness for local burning, but because of its general inaccessibility and the presence of larger, better, and more convenient deposits, its development as a commercial source of lime would not be profitable.

TABLE OF LIMESTONE ANALYSES.

The following table gives a summary of the results of the chemical tests made on the limestones of Pocahontas County, the samples having been taken in the field by the writer and the analyses made in the laboratory of the Survey by Dr. B. B. Kaplan, Chemist. It is only from the Union Member of the Greenbrier Limestone that anything approaching a complete set of samples was collected, but at least two or more representative samples were taken from the remainder of the calcareous members that appeared to have commercial value. Following the table are brief references to the formations and portions of the same sampled, property owners, locations of outcrops or quarries, the reference numbers being the same as those in the first column of the table:

Table of Limestone Analyses, Pocahontas County.

No. on Map II.	Sample No.	Name of Limestone.	Silica. (SiO_2)	Ferric Iron. (Fe_2O_3)	Alumina. (Al_2O_3)	Calcium Carbonate. ($CaCO_3$)	Magnesium Carbonate. ($MgCO_3$)	Phosphoric Acid. (P_2O_5)	Loss on Ignition.	Total.
1	21 PH	Union	4.64	0.45	1.15	92.42	1.45	....	0.22	100.33
2	27 PH	Union	15.00	1.05	2.91	48.00	32.88	....	0.15	99.99
3	28 PH	Union	5.54	0.61	0.99	91.91	1.15	....	0.18	100.38
4	29 PH	Union	5.00	0.26	0.52	92.32	1.65	....	0.21	99.96
5	35 PH	Union	1.76	0.17	1.21	94.08	1.44	....	0.90	99.56
6	36 PH	Union	1.60	0.18	0.46	97.27	0.75	trace	0.10	100.36
7	37 PH	Union	6.92	0.16	0.80	84.58	7.50	....	0.17	100.13
8	38 PH	Union	1.68	0.12	0.76	96.22	1.20	trace	0.18	100.16
9	39 PH	Union	12.36	0.46	1.06	66.74	18.34	....	0.65	99.61
10	60 PH	Union	5.34	0.21	0.76	90.65	1.88	....	0.86	99.70
11	63 PH	Union	1.26	0.08	0.36	97.54	0.18	....	0.60	100.02
12	72 PH	Union	1.28	0.10	0.46	97.22	0.41	trace	0.60	100.07
13	73 PH	Union	2.68	0.60	1.72	94.16	0.75	....	0.10	100.01
14	74 PH	Union	6.56	0.60	3.18	86.83	1.40	....	1.10	99.67
15	75 PH	Union	9.60	1.20	2.76	81.72	2.04	....	1.86	99.18
16	76 PH	Union	13.00	2.02	4.00	76.84	2.01	0.69	1.25	99.81
	Average	**Union**	5.89	0.52	1.44	86.78	4.69	0.04	0.57	99.93
17	25 PH	Pickaway	4.12	(0.94	)	92.53	2.31	trace	0.10	100.00
18	26 PH	Pickaway	9.04	0.47	0.53	87.94	0.96	....	0.52	99.46
19	40 PH	Pickaway	7.46	1.04	2.04	87.70	2.00	trace	0.10	100.34
	Average	**Pickaway**	6.87	(1.67	)	89.39	1.76	....	0.24	99.93
20	17 PH	Patton (oolitic)	1.00	0.20	0.60	96.06	2.43	....	0.10	100.39
21	41 PH	Patton (upper)	1.60	0.14	0.50	96.82	0.71	trace	0.19	99.96
22	52 PH	Patton (lower)	3.64	0.20	0.64	91.86	3.74	....	0.21	100.29
	Average	**Patton**	2.08	0.18	0.58	94.91	2.29	....	0.17	100.21
23	19 PH	Hillsdale or Sinks Grove	1.36	0.20	0.12	97.57	0.60	....	0.12	99.97
24	20 PH	Sinks Grove	14.74	0.12	3.88	67.81	12.35	....	1.08	99.98
	Average	**Sinks Grove**	8.05	0.16	2.00	82.69	6.48	....	0.60	99.98
25	30 PH	Hillsdale	11.80	0.60	11.84	45.32	29.76	....	0.30	99.62
26	31 PH	Hillsdale or Sinks Grove	2.30	0.18	0.30	95.96	0.98	....	0.17	99.89
	Average	**Hillsdale**	7.05	0.39	6.07	70.64	15.37	....	0.24	99.76
27	58 PH	Maccrady (Warsaw)	11.00	0.41	0.93	61.96	24.95	....	0.69	99.94
28	51 PH	Maccrady (Warsaw)	15.28	1.91	7.45	46.68	26.67	....	1.70	99.69
	Average	**Maccrady (Warsaw)**	13.14	1.16	4.19	54.32	25.81	....	1.20	99.82
29	34 PH	Helderberg?, Bossardville	3.76	0.37	0.53	94.57	0.60	....	0.18	100.01
30	66 PH	Bossardville	2.00	0.48	0.80	92.92	2.88	....	0.84	99.92

1. Union member of Greenbrier, along State highway 0.8 mile N. E. of Spice Post-Office.
2. Union member of Greenbrier, 1½ miles north of Hillsboro; J. S. McNeill farm.
3. Union member of Greenbrier, (next 8 ft. above No. 2), J. S. McNeill farm, 1½ miles north of Hillsboro.
4. Union member (oolite) of Greenbrier, (above No. 28), J. S. McNeill farm, 1½ miles north of Hillsboro.
5. Union member (upper) of Greenbrier, (15-ft. portion), along new State road one mile N. W. of Edray.
6. Union member of Greenbrier, (next 25 ft. below No. 5), along new State road one mile N. W. of Edray.
7. Union member of Greenbrier, (next 20 ft. below No. 6), along new State road one mile N. W. of Edray.
8. Union member of Greenbrier, (6-ft. oolite below No. 7), along new State road 0.9 mile N. W. of Edray.
9. Union member of Greenbrier, (10-ft. whitish limestone below No. 8), along new State road 0.9 mile N. W. of Edray.
10. Union member of Greenbrier, C. W. Kinnison farm, 2 miles N. W. of Hillsboro.
11. Union member of Greenbrier, along new State road one mile north of Linwood Post-Office.
12. Union (marble) member of Greenbrier, (light-gray oolite), J. S. McNeill farm 1½ miles north of Hillsboro.
13. Union (marble) member of Greenbrier, (pink oolite), J. S. McNeill farm 1½ miles north of Hillsboro.
14. Union (marble) member of Greenbrier, (dark-gray oolite), J. S. McNeill farm, 1½ miles north of Hillsboro.
15. Union (marble) member of Greenbrier, (crinoid-stem oolite), J. S. McNeill farm, 1½ miles north of Hillsboro.
16. Union (marble) member of Greenbrier, (dull red), along Stamping Creek at Raintown.
17. Pickaway member of Greenbrier, J. S. McNeill farm, 1.4 miles north of Hillsboro.
18. Pickaway member of Greenbrier, J. S. McNeill farm, 1.4 miles north of Hillsboro.
19. Pickaway member of Greenbrier, (25 ft. above Taggard oolite), along new State road west of Edray.
20. Patton (oolite) member of Greenbrier, along new State road one-fourth mile west of Edray.
21. Patton (upper) member of Greenbrier, along new State road one-fourth mile west of Edray.
22. Patton (lower) member of Greenbrier, along new State road, one-fourth mile west of Edray.
23. Sinks Grove member of Greenbrier, Pocahontas County Quarry (No. 3 on Map II), at Edray.
24. Sinks Grove member of Greenbrier, State Road Commission Quarry (No. 1 on Map II), on land of Fred Ruckman, at head of Stevens Hole Run, 0.8 mile northeast of Mill Point.
25. Hillsdale member of Greenbrier (10′ just above chert) Pocahontas County Quarry (No. 2 on Map II), on farm of Withrow McClintock, along Swago Creek, one-fourth mile northwest of Dry Creek School.
26. Hillsdale or Sinks Grove member of Greenbrier, (next 30 ft. above No. 25).
27. Maccrady (Warsaw) Limestone, McLaughlin Springs at Onoto; elevation (top), 2410′ B.; Pocahontas Coal and Land Company.

28. Maccrady (Warsaw) Limestone, McClintock Cave on McClintock Run, Withrow McClintoc.
29. Near Helderberg-Bossardville contact, (15-ft. grayish-blue limestone), along Knapp Creek 1.2 miles S. W. of Frost.
30. Bossardville Limestone, Clarence Buzzard, one mile N. W. of Frost.

CLAY.

GENERAL STATEMENT.

Clay, according to Ries[1], is an earthy substance of fine texture containing a mixture of hydrous aluminum silicates, with fragments of other minerals such as silicates, oxides, carbonates, etc., and colloidal material which may be of either organic or mineral character. The mass possesses plasticity (usually) when wet and becomes rock-hard when fired to at least a temperature of redness. The two most important classes of clays are **residual** and **transported.**

AVAILABLE CLAY AND SHALE.

Residual Clay.

Residual clay is a type which was derived from the decomposition of the parent rock and which now remains where it was formed. Furthermore the most important deposits are formed from crystalline rocks although similar clay may be formed from stratified beds. So far as known no crystalline rocks occur in Pocahontas County and hence there are no clays from such an origin but occasional clay beds are found in this region at localities where decomposition of the stratified rocks has been sufficient to produce a clay which is residual and which has not been carried off by erosion. As a matter of fact all the rocks contain a certain amount of clay but in most cases it is only a thin veneer and is now better suited for soils than for ceramic use. The limestones, however, often leave a residual clay of varying thickness composed of the insoluble argillaceous impurities of the original formation. Such deposits can be found along the present outcrops of the limestone series where the topography is such

[1]Ries, H., Economic Geology, 5th edition, p. 170; 1925.

that the decomposed product is not readily carried away by surface drainage.

In using a residual clay formed from decomposed limestone it is well to keep in mind that fragments of the limestone are quite injurious if not removed because when burned the limestone tends to slake and forms a cavity of weakness and a white blotch on the finished product.

Clays of the residual type from sedimentary rocks, although generally comparing unfavorably with the bedded deposits, can be used in making ordinary building brick and drainage tile.

E. H. McLaughlin Clay Exposure.—Along Browns Mountain and particularly on the farm of E. H. McLaughlin, one mile northeast of Browns Creek School, the Helderberg and Bossardville outcrops are, at the surface, composed largely of thin laminated clays, varying in color from red, purple, lavender, and yellow to white. Here the rocks are standing in almost vertical position and have a thickness of 75 to 100 feet. These clays appear to represent the residue from the decomposed limestones. While attaining beautiful colors and apparently good plasticity when worked with the hands, their chemical analysis shows them to be high in silica. Two samples of these clays were taken by the writer and analyzed in the Survey laboratory by Dr. B. B. Kaplan, Survey Chemist, and showed the following constituents, No. 22 being from the clay of variegated color and No. 23 from the white portion:

	No. 22. Per cent.	No. 23. Per cent.
Silica (SiO_2)	78.72	76.80
Ferric Iron (Fe_2O_3)	1.27	0.28
Alumina (Al_2O_3)	16.40	16.86
Lime (CaO)	.....	0.12
Magnesia (MgO)	.....	0.28
Potash (K_2O) + Soda (Na_2O)	.....	0.30
Loss on Ignition	3.80	4.80
Total	100.19	99.44

Because of the fact that these clays can be seen only in the stream bed no estimate can be made of their extent. They appear, however, to be worthy of further investigation.

Lee Galfred and Samson Stalnaker Clay Prospects.—There might be some question as to whether or not the clay found along the West Fork of the Greenbrier River, starting a few miles north of Durbin and extending to the Randolph County line, should be considered as residual or transported clay, or shale. It is the writer's opinion, however, that these deposits represent a decomposed residue or weathered Pocono shale.

At the Pocono horizon there exists a soft plastic putty-like clay which is yellowish-brown in color and apparently of great quantity. It was noted at many points where the small lateral streams had cut across the horizon. Although it had been prospected by various clay manufacturers, at no point could its entire thickness be seen. Its horizontal extent, however, covers several miles.

Two samples of this clay were taken by the writer and analyzed in the laboratory of the Survey by Dr. B. B. Kaplan, Chemist,—No. 49 from the land of **Lee Galfred**, 3 miles west of Braucher, and No. 69 from the farm of **Samson Stalnaker**, 0.5 mile north of Wildell. The analyses follow:

	No. 49. Lee Galfred. Per cent.	No. 69. Samson Stalnaker. Per cent.
Silica (SiO_2)................	68.28	71.24
Ferric Iron (Fe_2O_3).........	8.29	3.19
Alumina (Al_2O_3)............	16.85	18.75
Magnesia (MgO)............	1.48	1.21
Loss on Ignition...........	5.19	5.16
Total....................	100.09	99.55

These clays are very accessibly located within very close proximity to the Durbin Branch of the Western Maryland Railway and are worth further investigation by the ceramic industry.

Transported Clay and Consolidated Clay or Shale.

Along the river valleys there are many points that retain considerable deposits of river clay which were derived from the decomposition of the rocks over which these streams flowed. These clays are suitable for the manufacture of brick or drainage tile, although the product might not compare favorably with the results from the original material as the sorting is often less complete. These deposits are included under Alluvium and are noted on Map II.

The consolidated clays or shales, composed principally of silica and alumina, with varying quantities of ferric iron and other minor impurities and having sufficient plasticity for molding, occur in large quantities over the county. Throughout the Mauch Chunk Series, described in detail in Chapter VII on stratigraphy of the series and shown by outcrop on Map II, there are vast quantities of red shale suitable for building brick or drainage tile. Because of the generally high ferric iron content the finished product would have a pleasing red color without the need of adding a flux.

In the Maccrady Series of the Mississippian the same condition is true except that the quantity is less but the shales of this series are generally more accessible. The outcrop of this series is shown on Figure 8 and in greater detail on Map II. A sample of this shale was taken along the highway 1½ miles southwest of Buckeye. According to Dr. Kaplan, Survey Chemist, its constituents are as follows:

	Per cent.
Silica (SiO_2)	59.00
Ferric Iron (Fe_2O_3)	9.73
Alumina (Al_2O_3)	26.00
Loss on Ignition	5.40
Total	100.13

The analysis of this shale shows it not only suitable for the manufacture of brick and tile, but also as a mixing agent with the comparatively high-silica limestone to increase the relative proportion of alumina for Portland cement, since it contains an unusually high alumina content. Inasmuch as this shale lies immediately below the Greenbrier Limestone, some of which contains silica without much alumina, it is worthy of attention.

In the Pocono Series in general the shales are too closely associated with sandstone to offer much inducement to the ceramic industry. Attention has already been called, however, to the development of Pocono clays along the West

Fork of the Greenbrier River in the northern part of the county.

In the Devonian Period the shales of the Catskill Series correspond favorably with those of the Mauch Chunk and are located in most cases along the Chesapeake and Ohio Railway so that they are easily available. The shales of the Chemung and Portage Series are interbedded with flaggy sandstones so that they offer little inducement, while the black Genesee and Marcellus Shales, lower down, contain so much organic matter that their shrinkage would be too great.

In the Silurian Period shales occur in the Clinton and Red Medina Series. In some cases the former by careful selection might be successfully used for building brick or tile, but their exposures are generally inaccessible so that the better located deposits would naturally outrank them in importance.

Fire Clay.

The true fire clays that have a quality of resisting high furnace temperatures are not known to occur in the county. It is possible that in the western portion of the county some of these clays may be associated with the coals but all clays associated with the coals are not fire clays, so that only further investigation will definitely determine their presence. Even if present, however, their general inaccessibility would prevent their use in the near future.

BUILDING STONE.

QUARRIES.

In Chapters VI-XI inclusive, dealing with stratigraphy the sandstones have been described, with attention called to those which have been quarried or which are suitable for masonry construction; and at the beginning of Chapter XIV the limestone quarries have been noted. Very seldom have the local sandstones been utilized for building purposes, the stone being used mostly for railroad bridge abutments and for a few of the larger buildings of Marlinton.

AVAILABLE STONE.

The sandstones of the county, as described in Part II of this report, vary from thin flaggy and shaly beds that are of no value as building stone to massive ledges 50 to 75 feet in thickness that can be worked into any desired shape. In the Pottsville Series there are several coarse, gray to white sandstones that can be used locally for dimension stone as the needs arise. In the Mauch Chunk Series many of the sandstones are often shaly and lenticular, while others are of massive and durable character with a pleasing texture. In the Greenbrier Series there are no sandstones suitable for building stone but some of the limestones might be successfully used for such purposes. The Union or "Marble" member will be discussed more in detail on the following pages. The Maccrady Series offers no stone durable enough for construction material, but the Broad Ford Sandstone member of the underlying Pocono often attains a character suitable for dimension stone. As previously noted it has been quarried quite extensively at Marlinton and at many other points along the Greenbrier River for use in bridge abutments, building foundations and steps, where durability and abrasive resistance are important.

In the Devonian Period the Catskill Series contains numerous ledges of sandstone that are often shaly and lenticular but occasionally quite massive and durable with colors of brown and red. In the Chemung and Portage Series the sandstones are generally flaggy but often attain beds of considerable thickness. These beds weather out, breaking along the joint-planes into rectangular shapes of various sizes and with very smooth faces, so that further shaping is unnecessary. The colors vary from gray to brown to green and buff. That a market could be found for these flags is quite likely since structures built from them are not only pleasing in appearance but very durable. Several of the Universities of central New York have constructed some of their finest buildings from stone of similar character.

The Genesee, Hamilton, and Marcellus Series are quite devoid of any rocks suitable for building stone in this county.

The Oriskany is often massive and persistent but in this area it is generally unfit for masonry.

In the Silurian Period there are heavy sandstones in the Clinton Series, two of which are quartzitic and very durable but of such a character as to be very difficult to work, while a third, or "Iron Sandstone", is of a red color, very durable and often weathers into rectangular blocks so that further shaping is seldom necessary. Where these beds are not already broken by gravity, it is very difficult to shape them. The White Medina Sandstone is massive and generally quite quartzitic, like those of the Clinton, and it is very difficult to work into any desirable shapes. In the Red Medina the sandstones are generally too shaly and irregular to be of any value.

POCAHONTAS "MARBLE"[2]

In the vicinity of Hillsboro, (See Figure 20-A), the Union member, occurring near the top of the Greenbrier Series, has attained a character that classifies it, to the trade, as a grade of marble. This member, which is highly fossiliferous, contains such marine life as blastoids **(Pentremites)**, crinoids, brachiopods, corals, gastropods, and bryozoa **(Archimedes)**. Along with this abundance of marine life are millions of minute concretions resembling fish roe which are called oolite. Either at the time of deposition or by later infiltration from circulating waters (probably the former) sufficient coloring was carried in to give it a pleasing appearance to the eye, more especially when polished. These deposits vary in color from red to maroon to a pinkish tinge and from that to the various shades of gray. This marble phase varies from 25 to 40 feet in thickness, being red or maroon, highly fossiliferous and oolitic at the top, and blending into a light fossiliferous oolite, with the various shades of gray, at the base. This horizon will produce stone suitable for ornamental purposes.

Above the red is a 20-foot highly fossiliferous, fine-grained, gray limestone that could also be used as a building stone. Along Marble Run there is a concealed interval of 35 feet beneath the above-named gray and then a ten-foot

[2]Price, Paul H., Marble Deposits of Pocahontas County, W. Va., Proc., W. Va. Academy of Science, Vol. 2, pp. 107-117; 1928.

stratum of very fossiliferous light-gray limestone in which some of the fossils are filled with pink calcite, thus giving a beautiful surface when polished. These observations show that there is a workable face of about 40 feet with the possibility of using both the overlying and underlying layers for different grades of building stone. If this could be done it would increase the thickness to some 75 feet. Although the marble phase of these deposits is limited to the darker shades, the material presents a very pleasing appearance when polished.

A better idea of the character, contents, and structure can be gained from an examination of thin sections of the rocks under the microscope. Several samples for this purpose were taken from the area in the vicinity of Hillsboro by the writer from which sections were prepared by W. Harold Tomlinson of Swarthmore, Pa. As would be expected the predominating constituent is calcium carbonate, largely from the shells of marine organisms, ranging from 76 to 97 per cent. Silica, both colloidal and crystalline, is present in small quantities ranging from a little over one to 13 per cent. A small amount of ferric iron is present to give it color, along with small amounts of alumina, magnesium carbonate and a trace of phosphoric acid. These sections, as enlarged by Prof. W. E. Rumsey and A. Berg of the West Virginia Agricultural Experiment Station, are herewith reproduced as Plates Nos. LIX to LXIII.

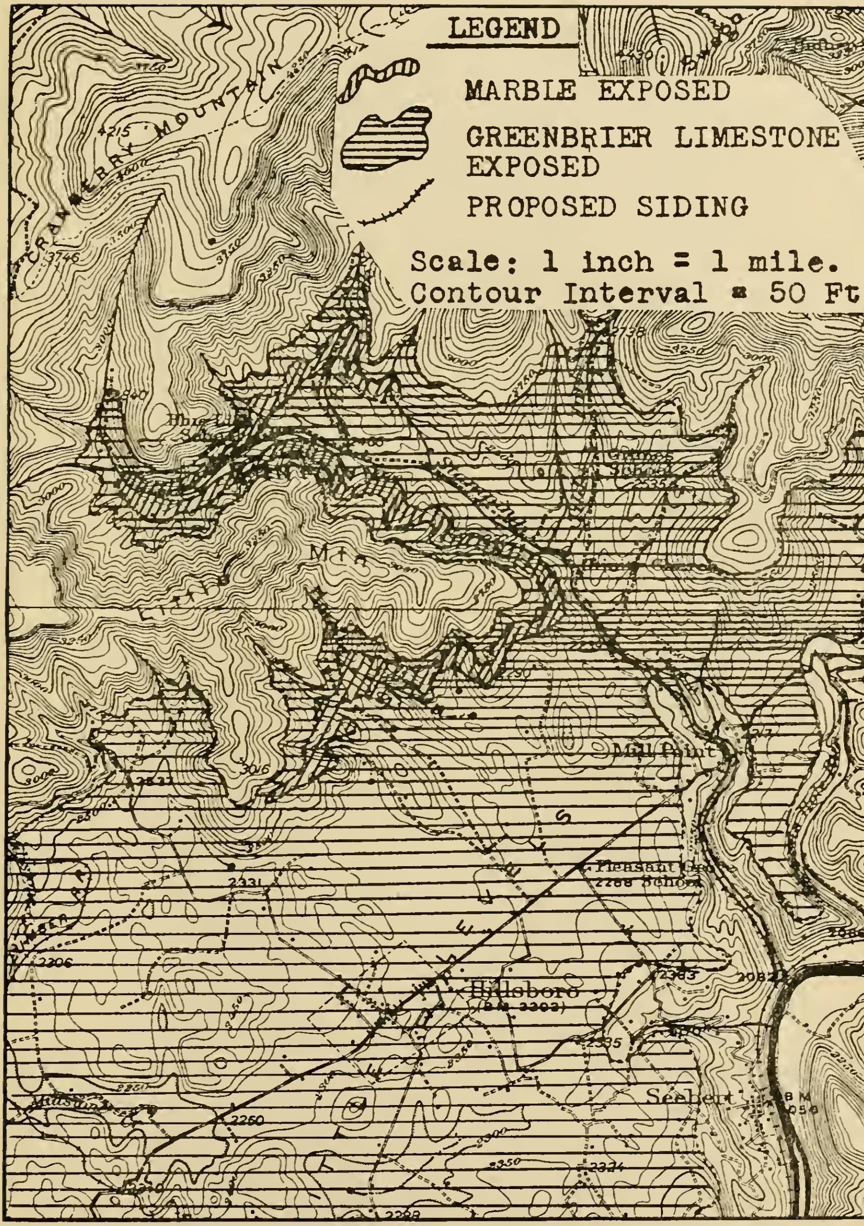

Figure 20-A.—Map showing location of "Marble" exposures on Stamping Creek north of Hillsboro.

The chemical composition of these respective horizons is included in the Table of Limestone Analyses, page 333, as samples Nos. 72 PH, 73 PH, 74 PH, 75 PH, 76 PH.

From the above discussion it can be seen that in the area under consideration the deposits in the vicinity of Hillsboro offer opportunities for exploitation. Besides the marble phase, which is suitable for ornamental stone, underlying beds are adaptable for general masonry stone, and the manufacture of Portland cement or other uses for which a high calcium carbonate content is desired. The ideal situation would be a combination of plants that would utilize all the by-products of one large quarry operation.

ROAD MATERIAL.

In Pocahontas County there is an abundance of material suitable for road construction some of which has been used quite extensively for local work. (See Plates LIII, LIV, LV, LVI and LVII).

Limestone.—Probably the best local material for road building is limestone. As already pointed out vast deposits of limestone are available, being well distributed over the county and often outcropping along the roads, so that almost any amount needed can be secured close at hand or with very little distance for transportation. West of the Greenbrier River and roughly paralleling it the thick-bedded deposits of the Greenbrier Series outcrop extend the entire length of the county. It again gets above drainage along Elk River and its tributaries so that any amount of limestone can be had from this series for those roads lying west of the Greenbrier River. (See Figure 7).

East of the Greenbrier River the lower limestones including the Helderberg of the Devonian as well as the Salina and Niagara Series of the Silurian are exposed the entire length of Beaver Lick-Browns-Michael Mountains so that material from these horizons is in easy reach for the roads lying east of the Greenbrier River. (See Figures 12 and 13).

Chert.—Oftentimes when there are many roads to be surfaced the use of limestone becomes too expensive, and a

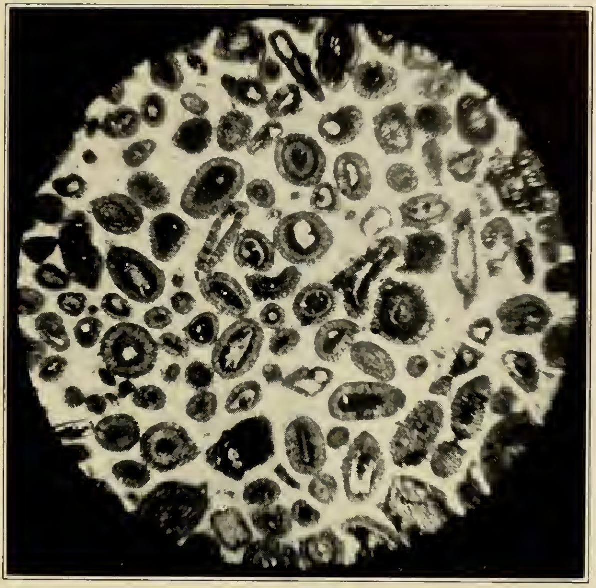

PLATE LIX.—Photomicrograph.—Light-gray oolite, Union Limestone. x 20. (Photo. by A. Berg and W. E. Rumsey).

PLATE LX.—Photomicrograph.—Pink- or dove-colored oolite, Union Limestone. x about 20. (Photo. by A. Berg and W. E. Rumsey).

PLATE LXI.—Photomicrograph.—Dark-gray oolite, Union Limestone. x about 20. (Photo. by A. Berg and W. E. Rumsey).

PLATE LXII.—Photomicrograph—.Dark-gray (crinoid stem) oolite, Union Limestone. x 20. (Photo. by A. Berg and W. E. Rumsey).

PLATE LXIII.—Photomicrograph.—Dull-red, Union Limestone. x 20. (Photo. by A. Berg and W. E. Rumsey).

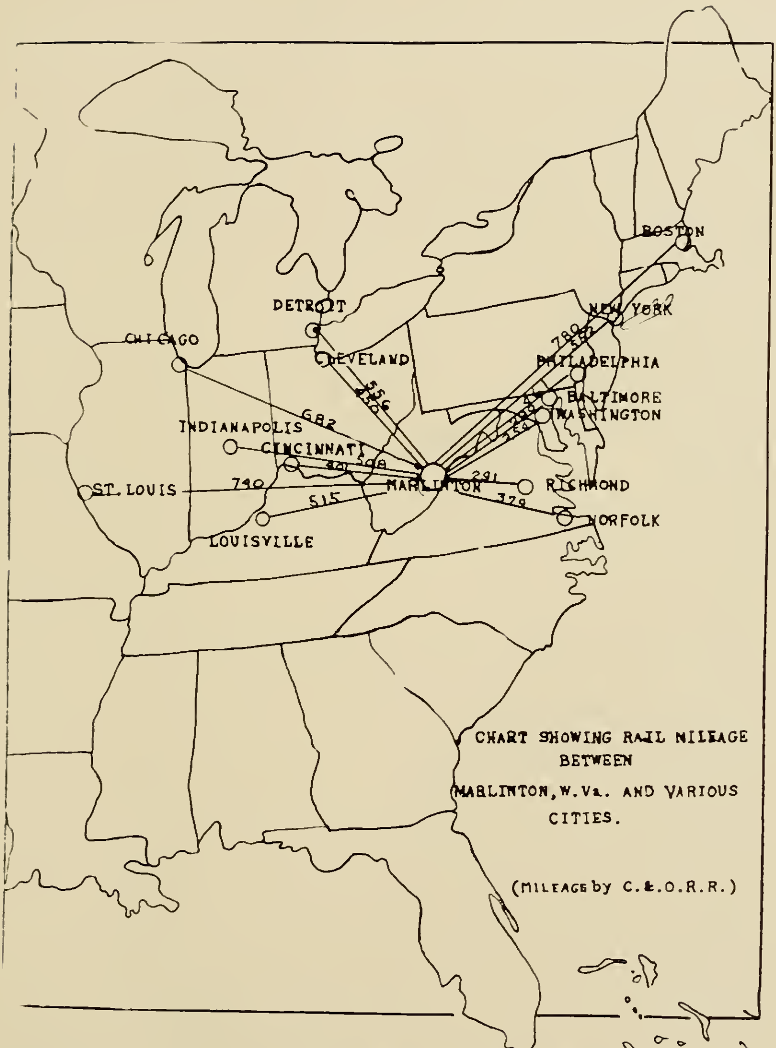

Figure 20-B.—Chart showing Rail Mileage between Marlinton, W. Va., and Various Cities (Mileage by C. & O. R. R.).

cheaper material is sought. In this respect Pocahontas County is quite fortunate in having large deposits of weathered chert beds that make an excellent road-surfacing material. This member (Huntersville Chert) has been described in detail on pages 236-239. These chert deposits outcrop on either side of Beaver Lick-Browns-Michael Mountains from the Greenbrier County line to Green Bank on its northern extension and can be seen on Figure 12. This material had already been used quite extensively for surfacing many of the roads east of the Greenbrier River and especially State highways Nos. 42 and 43 from Marlinton to Green Bank. The chert fragments are found weathered out in loose deposits along the outcrop of the Huntersville Chert member so that the material can be readily handled by steam shovels. (See Plates LVI and LVII). When spread upon the road, scraping to keep the surface smooth is the only treatment necessary while the finer particles of clay, sand, iron, and lime that may be present form an excellent binder under the weight of traffic. In the second year a coating of asphalt mixed with fine lime can be put on and a very good hard-surfaced road is the result.

River and Creek Gravel.—Many of the rivers and larger creeks contain large amounts of gravel, which is the more resistant portions of the rocks from which they came, and afford a cheap supply of good material for road improvement. This gravel may be used particularly to improve muddy roads of secondary importance, where paved roads would be too expensive to maintain. Usually a good grade of gravel can be secured for aggregate for concrete paving, bridge abutments, and concrete structures in general.

Sand.—Sand, which is an important item in road building both for masonry and concrete, can generally be found along the rivers and creeks, being derived from the weathering of the various sandstones from the Pottsville Series down to and including the Medinas. Sand of a better quality can be secured by crushing it from the sandstones, but it is generally quite expensive. In some instances these horizons have been sufficiently weathered or decayed to furnish quantities of sand at their outcrops. This is particularly true of the Oriskany

Sandstone at many points along its outcrop, and of the Droop Sandstone on Droop Mountain. At the latter locality the sandstone caps the mountain for several square miles and lies in practically a horizontal position. In many places its upper portion has been so much decayed that large quantities of clean loose sand are available.

In addition to these materials there are numerous sandstones as well as arenaceous and calcareous shales that may often be used advantageously on the local roads to improve their condition.

GLASS-SAND.

No development of glass-sand has been attempted in Pocahontas County, although there are one or more deposits that deserve detailed investigation. Since silica is the major ingredient of glass-sand, it influences the character of the ware. Sands with impurities, unless they can be easily removed, and especially if they are to be used for the higher grades of glassware, should be avoided. Chemical analyses of most sands show at least traces of iron oxide, alumina, titanium oxide, lime, magnesia, and organic matter, but these are often included in mineral grains separate from the quartz and may be easily removed.

Along with a good sand two other factors are important, one being a favorable quarry site and the other, access to good transportation. These various factors were considered in sampling sandstones for analysis in Pocahontas County. Among the numerous sandstones available only two offer glass-sand possibilities, these being the Droop and White Medina Sandstones. The Oriskany Sandstone, which is quarried extensively in Berkeley County, is generally quite impure in Pocahontas.

The Droop Sandstone that covers several hundred acres on Droop Mountain meets the general requirements of a glass-sand unless it should be too fine. Unfortunately no screen tests were made but the sand is in general quite fine and might not all be retained on the 120-mesh which is usually demanded.

Two samples of this sandstone were taken in the field by the writer and analyzed in the Survey laboratory by Dr. B. B. Kaplan, Chemist. The contents were as follows:

	Sample No. 53 PH. Per cent.	Sample No. 64 PH. Per cent.
Silica (SiO_2)	98.18	98.14
Ferric Iron (Fe_2O_3)	0.36	0.12
Alumina (Al_2O_3)	0.70	0.56
Magnesia (MgO)	0.22	0.26
Potash (K_2O) + Soda (Na_2O)	0.11	0.21
Loss on Ignition	0.46	0.46
Total	100.03	99.75

Sample No. 53, taken on Droop Mountain, along Millstone Creek, one mile north of Caesar Mountain School.

Sample No. 64, taken from ledge on Droop Mountain 0.2 mile northwest of Mt. Zion Church.

With reference to No. 64 PH., Dr. Kaplan reported that by washing with dilute muriatic acid practically all the impurities were removed and left a product of great purity.

The White Medina Sandstone is often quite quartzitic in character and would be expensive to crush. At some localities, however, it appears to be more porous and offers glass-sand possibilities. Such an exposure is seen near Minnehaha Springs where the following sample was collected:

	Sample No. 61 PH. Per cent.
Silica (SiO_2)	97.76
Ferric Iron (Fe_2O_3)	1.28
Alumina (Al_2O_3)	0.62
Magnesia (MgO)	0.05
Loss on Ignition	0.00
Total	99.71

Dr. Kaplan, who analyzed the above sample, also notes that the iron content can be almost completely removed by washing with dilute muriatic acid.

In view of the great amount of sand at these two respective horizons, and particularly the former or Droop Mountain area, where it is practically free from cover and where it could be lowered by gravity to the Chesapeake and

Ohio Railway along which there is an ample supply of water for washing, it is apparent that a thorough prospecting by those interested in the glass-sand industry might be undertaken with profit.

FORESTS.

In Volume V, pages 237-249, of the Survey Reports (1911) Mr. A. B. Brooks, former State Forester, has described briefly the forests and lumber industry of Pocahontas County. The descriptions of present conditions and lumber mills are now out of date but certain other items are of much interest.

Topography.

Under the head of Topography the description of land forms and drainage is now superseded by a more detailed account in the early pages of the present Report but Mr. Brooks furnishes an interesting list of high mountain peaks. This list, amplified and revised by R. C. Tucker, Assistant Geologist, from the new topographic maps, is as follows:

	Feet.
Bald Knob	4,842
Thorny Flat (Cheat Mountain)	4,839
Spruce Knob	4,710
Mace Knob	4,705
Beech Flat Knob	4,700+
Big Spruce Knob	4,695
Elleber Ridge	4,602
Barlow Top	4,600
Watering Pond Knob	4,587
Gay Knob	4,545
Sharp Knob	4,535
Briery Knob	4,518
Ward Knob	4,507
Guinn Ridge	4,500
Bear Mountain	4,467
High Rock	4,450
Blue Knob	4,426
Gibson Knob	4,415
Locust Knob	4,310
Little Spruce Knob	4,260
Buck Knob	4,250+
Colaw Knob	4,218
Smoke Camp Knob	4,218
Moffett Knob	4,170
Bayard Knob	4,155

Original Timber Conditions.

The account of original timber conditions by Mr. Brooks is as follows:

"The county has been and still remains, one of the most important timber regions of the State. Red spruce once covered the high mountains lying west of the Greenbrier River basin and a large area in the north drained by the headwaters of the Greenbrier and Shavers Fork of Cheat. With and near the spruce grew such other woods as hemlock, black cherry, yellow birch, sugar maple, beech, and chestnut. On the lower grounds between the mountainous sections of the east and west grew most of the hardwoods common to central West Virginia. These included such species as yellow poplar, black walnut, white and red oaks, basswood, white ash, hickories, and maples. East of the Greenbrier River, even on the highest elevations, spruce was not found to any extent south of the town of Green Bank. White pine was distributed in large areas along Deer Creek, Sitlington Creek, Knapp Creek, and other eastern tributaries of the Greenbrier River. The original stand of white pine has been estimated by some at 600 million feet, and by others at 1 billion feet."

Present Forest Conditions.

In contrast to the description of Mr. Brooks as of 1911 when Pocahontas County had 212,000 acres of virgin forest, there now remain only a few thousand acres of undisturbed timber, partly on the headwaters of Elk, Gauley, and Williams Rivers and partly in scattered woodlots elsewhere. The cut-over forest figure of 138,000 acres, noted by Mr. Brooks in 1911, has had an increase almost equal to the decline in virgin forest. With proper care, such as is now afforded by the combined State, Government, and private forest protection service the cut-over lands should rapidly develop a new growth of valuable timber.

National and State Forests and Parks.

In addition to the Droop Mountain Battlefield Park, described on pages 6-7, there are two other forests within the area of Pocahontas County, the Monongahela National Forest, and the Watoga State Forest. The approximate location of these is shown on Figure 21.

Watoga State Forest.—According to a recent article in "The Pocahontas Times" (February, 1928), the Watoga State

Forest consists of 4,641 acres of cut-over timber land on the watershed of Rock Run and Island Lick Run. It lies below Watoga and opposite Seebert. The timber was cut some 15 years ago or more. It is a pleasant wooded country, and even should the blight kill all the chestnut there are enough trees of other kinds on most of the area to make good cover for the game, many signs of which were noted by the State foresters who recently made an estimate of the chestnut timber. There are two trails through the forest, both of which are marked on the Marlinton Quadrangle.

Monongahela National Forest.—The purchase unit of the Monongahela National Forest in Pocahontas County includes the territory east of the West Fork of Greenbrier River from Durbin northward to Wildell and the Randolph County line south of Beulah, and lying north of the Staunton and Parkersburg Pike. The eastern boundary of the National Forest extends over into Virginia along the Pike, thence northeastward to headwaters of Back Creek and Straight Fork to Hardscrabble, and thence in the same direction in Pendleton County along North Fork to Circleville, Mouth of Seneca, to the Hopeville Gap in Grant County.

Up to June 30, 1928, 28,618 acres had been purchased in Pocahontas County, mainly on Burner Mountain south of Bearwallow Run of East Fork of Greenbrier River and south of the headwaters of Span Oak and Elklick Runs of Little River of West Fork of Greenbrier River; another large tract southeast of the East Fork of Greenbrier River on Frank Mountain, Spruce and Little Spruce Ridges and along the Allegheny Mountain to Elk Mountain, Pendleton County; and another smaller area along the West Fork of Greenbrier River north of Durbin to near Braucher on waters of Mountainlick Creek.

Other areas purchased in West Virginia include 10 acres in Grant County, 28,645 acres in Pendleton, 66,987 in Randolph, and 53,546 in Tucker, making a total of 177,806 acres in the State, at a total cost of $549,587.16, or an average price of $3.09 per acre. An additional 50,156 acres in West Virginia has been approved for purchase at a cost of $224,700.54.

The report of the National Forest Reservation Commission for the year ended June 30, 1928, shows that 10,414 acres had been purchased in the State of Virginia in Highland County at an average price of $2.70 per acre, or a total consideration of $28,148.40, this area including all the lands so far approved for purchase in Virginia. According to the report for 1927, an additional area of 11,440 acres in Highland County is under consideration but has not been approved for purchase.

The following table has been compiled from page 9 of the 1928 report mentioned above:

		Approved for purchase.			Acquired.		
County.	Acres.	Acres.	Ave. Price	Total Price	Acres.	Ave. Price	Total Price.
Grant	38,900	6,118	$7.49	$ 45,833.88	10	$2.39	$ 23.88
Pendleton ...	163,800	30,945	3.00	92,832.05	28,645	2.64	75,582.05
Pocahontas ..	71,978	38,420	3.60	138,267.15	28,618	3.59	102,700.71
Preston	15,100	3,390	3.76	12,712.50	....	......	....
Randolph	193,980	84,016	3.18	267,041.08	66,987	3.01	201,355.11
Tucker	234,850	65,073	3.34	217,601.04	53,546	3.17	169,925.41
	718,608	227,962	$3.40	$774,287.70	177,806	$3.09	$549,587.16

On pages 17-18 of the report last mentioned, the following information is given concerning the Monongahela purchase unit:

"During the past year authority was granted to purchase 10 tracts, having an aggregate area of 43,779 acres, at an average price of $4.59 an acre. There has thus been approved for purchase a total of 238,376 acres of lands within this unit, amounting to 47 per cent. of the purchasable area. This unit was extended to the east during the past year so as to include an additional area of about 84,000 acres in Grant and Pendleton Counties, W. Va., and largely upon the North Fork and Cave Mountain. No purchase of lands has as yet been authorized in this extension, but a large area has been examined and reported upon. This addition will be in large part offset by the elimination from the purchase unit of lands which contain a higher proportion of farms.

"During the current year the acreage approved for purchase in this unit was a larger percentage of the purchasable area than upon any other within the eastern district, the proportion of consolidation being increased from 30 to 47 per cent. of the purchasable area. For many years purchase work lagged upon this unit, due to the fact that sawmill owners cutting over large tracts had not completed their operations and did not desire to sell their land until cutting was finished. During the past few years, however, a number of companies have completed their operations and offered their lands for sale, and the prospect is that other owners will offer a large additional area within the next few years. The lands which have been acquired are still grouped in several disjoined bodies the consolidation of which can not be effected until some of the owners which are still operating are in a position to offer their lands. Furthermore, a broad belt of agricultural lands of high value for grazing nearly bisects the unit. Since it will not be desirable to acquire these farming lands, the forest must remain essentially divided into two portions.

"Most of the lands on this unit are potentially of high productive capacity, whenever they are well stocked and are furnished with adequate protection against fire. This unit includes one of the largest areas of the spruce type south of the Adirondacks, and in case this valuable timber can be reestablished in places where it has been destroyed as a result of fires after lumbering it will become a valuable source of supply of material for paper stock.

"It is estimated that out of 43,000 acres of open land in this unit, about 20,000 acres will require planting to secure a reestablishment of a valuable species. Some of this open land is in bracken fern, some in such shrubs as sumach, prickly ash, and brambles, and on some the establishment of the worthless fire cherry will make artificial restocking to a valuable species a more costly and prolonged process. In order to provide planting stock not only for the Monongahela National Forest, but for supplying stock to other forests upon which there are areas of open land which should be restocked by planting, a forest nursery was established at Gladwin, W. Va. The capacity of this nursery during the year 1926 was about 125,000 2-year old trees planted. This was found to be insufficient to supply the stock needed for planting up the extensive areas of devastated land and abandoned hillside and gullying farming lands which have been acquired. The Gladwin Nursery was also poorly situated in respect to shipping facilities. For this reason the purchase was authorized of 28.8 acres of land (at a cost of $2800.000, $97.22 an acre; p. 15 of report cited), a large portion of it level river alluvial about 1 mile outside the city of Parsons, W. Va., which not only has an excellent nursery soil, good shipping facilities, within 1 mile of the station and immediately upon a highway, but has a capacity for producing all the planting stock which will be required. Its improvement is already under way. The chief species which will be produced are white pine, larch, Norway spruce, and red spruce.

"Eighteen towns and cities secure their domestic water-supply from lands located within the exterior boundary of this unit, and in 10 cases the supply is wholly or in part derived from national-forest lands.

"Spruce Mountain, the highest point in the State of West Virginia, is within this unit."

PLATE LXIV.—Pictograph. (See description under Plate LXV below). (Photo. by Paul H. Price).

PLATE LXV.—Pictograph. (Photo. by Paul H. Price). PLATES LXIV. and LXV.—Pictographs. These carvings upon the Pottsville Conglomerate boulder (now resting upon Pocono beds) were called to the attention of the author by Dave L. Beverage of Stony Bottom. After retouching with chalk, an examination reveals apparent turkey and panther tracks, pipe, and other symbols. It is known to be in the vicinity of Indian camping grounds, and is thus believed to be markings left by them. It can be seen on the farm of John Hevener on Glade Run, near Stony Bottom.

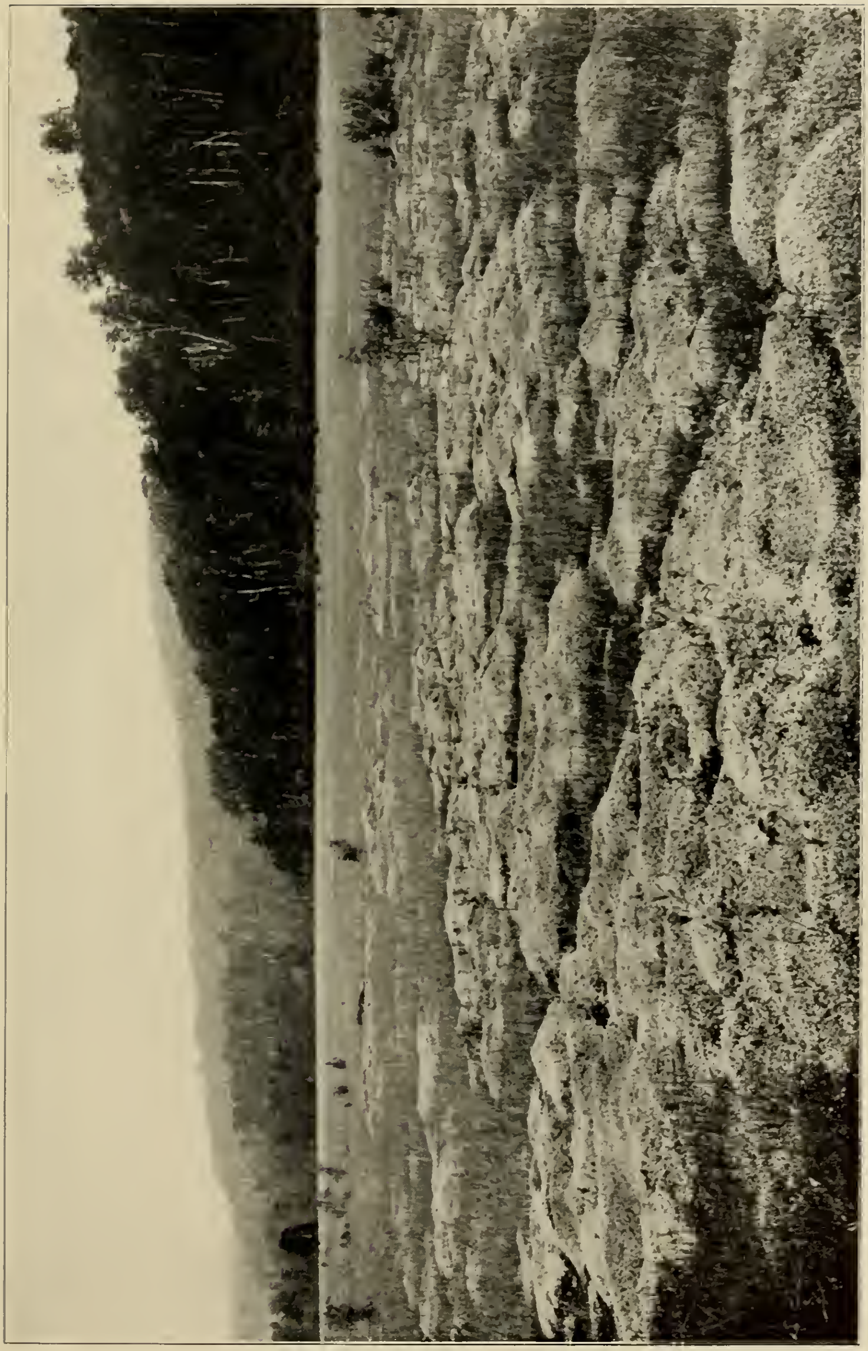

PLATE LXVI.—Lichen beds in Cranberry Glades. (Photo. republished from page 244 of Volume V of the Survey).

PLATE LXVII.—Typical view in the open part of Cranberry Glades. (Photo.republished from page 380 of Volume V of the Survey).

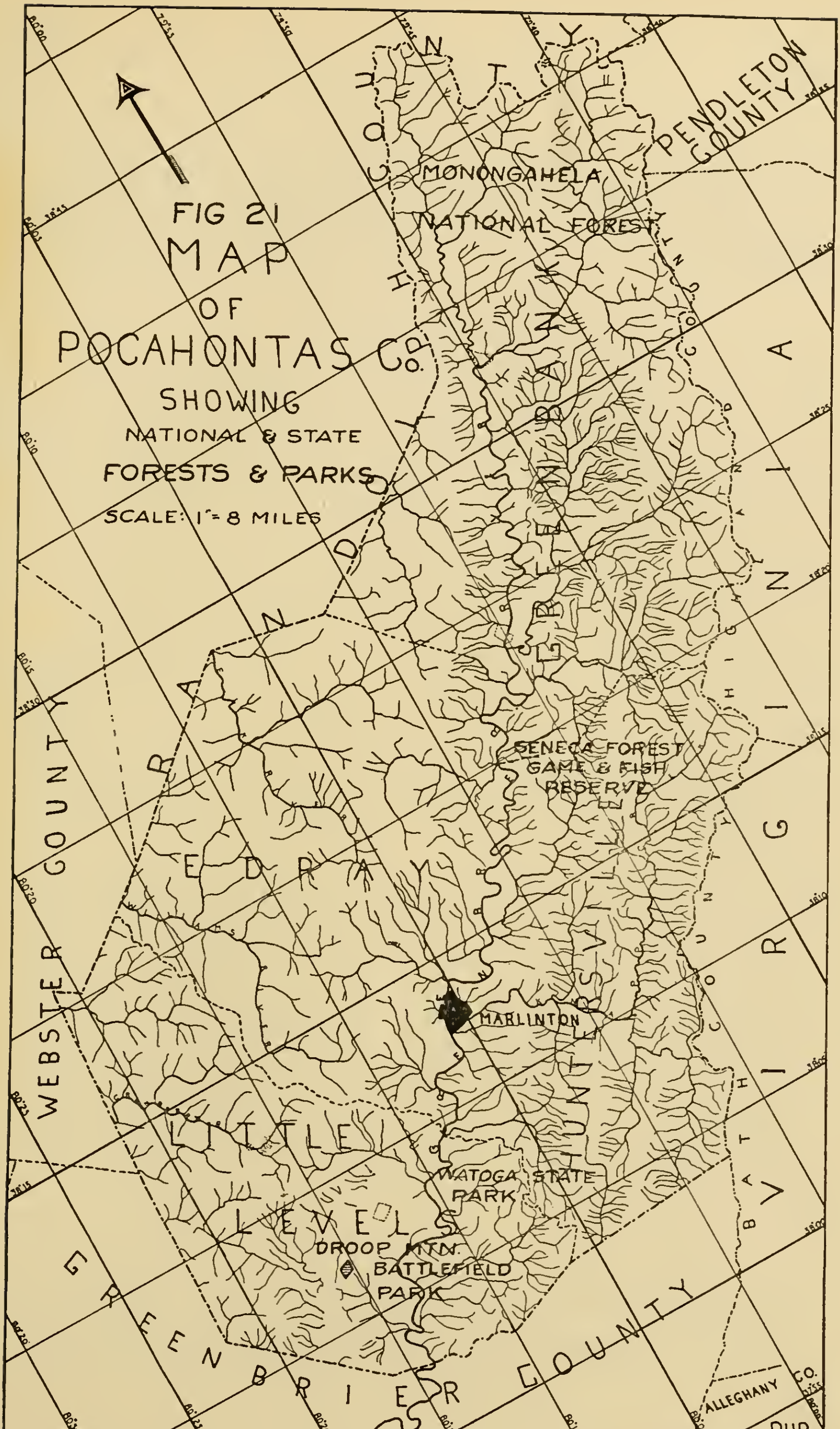

FIG 21
MAP
OF
POCAHONTAS Co.
SHOWING
NATIONAL & STATE
FORESTS & PARKS
SCALE: 1" = 8 MILES

Lumber Mills.

Polk's Gazetteer of West Virginia for 1923-24 lists the following lumber manufacturers in Pocahontas County by towns:

Boyer—North Fork Lumber Co.
Clover Lick—A. D. Neill & Son.
Deer Creek—Range Lumber Co.
Edray—E. H. Robertson.
Frost—Warn Lumber Co.
Hillsboro—Bartholomew Saw Mill Co.
Hillsboro—F. P. Kidd.
Huntersville—M. P. Moore.
Huntersville—Cecil Sheets.
Locust—Spice Run Lumber Co.
Locust—Russell R. Turpin.
Marlinton—Marlin Lumber Co.
Marlinton—Williams & Pifer Lumber Co.
Nottingham—North Fork Lumber Co.
Raywood—Warn Lumber Corporation.
Slaty Fork—West Virginia Pulp & Paper Co.
Spice—F. P. Kidd.

Cranberry Glades.

Mr. Brooks' account of the modern flora found in the Cranberry Glades is most interesting and is herewith repeated as follows:

"The high region covering the western part of Pocahontas County, drained by hundreds of clear mountain brooks that flow into the Cranberry, the Williams, the Gauley, and the Elk Rivers, was once known as the 'Wilderness' or the 'Wilds of Pocahontas', a region until recently overgrown with a dense, undisturbed forest and abounding in game of many kinds. Here, in the midst of the 'Wilderness' and on the border of the greatest forest remaining in the State, are the Cranberry Glades near the head of Cranberry River.

"There is, in reality, only one glade, containing from 250 to 300 acres of deep, wet soil overgrown in some places with a thicket of shrubbery and in others carpeted with lichens, mosses, and sedges. Within the glade there are 5 open spaces the names and areas of which are given below:

"Big Glade	56 acres.
Flag Glade	20 acres.
Long Glade	14 acres.
Round Glade	8 acres.
Little Glade	2 acres.

"Each open area is separated from the others by winding and sluggish streams which are bordered by fringes of alder, hollies, and other shrubs.

"There is, perhaps, no area of equal extent in West Virginia which is of greater importance for its influence on water flow, nor one more interesting to the student and collector on account of its varied forms of plant and animal life than this glady region lying at an elevation of 3,400 feet above the sea and surrounded by mountains which rise from 1,000 to 1,500 feet above it.

"A few of the characteristic species of plants, mammals, and birds collected by a party which visited the Glades in July, 1909, are named below:

"**Plants.**

"Red Spruce, **Picea rubens**. Abundant on margins of glades and on mountain summits.

"Quaking Aspen, **Populus tremuloides**. Growing on margin of glades.

"Mountain-Ash, **Sorbus americana**. Common around glades.

"Ground Hemlock, **Taxus canadensis**. Shrub growing abundantly in wet, shady places.

"North Rattlesnake Plantain, **Epipactis revens** var. **ophioides**.

"Collected by Dr. John L. Sheldon under a hemlock tree near the edge of the glades:

"Rose Pogonia, **Pogonia ophioglossoides**. Common in sphagnum moss in open glades.

"Horned Bladderwort, **Utricularia cornuta**. Found growing in Big Glade.

"Round-leaved Sundew, **Drosera rotundifolia**. Common in open glades.

"Sphagnum Moss, **Sphagnum Girgensohnii** Russ. This northern species was found growing with other Sphagnums in the glades and collected by Dr. Sheldon.

"American Cranberry, **Vaccinium macrocarpon**. Common on edges of open glades.

"Small Cranberry, **Vaccinium oxycoccos**. Abundant over all the open glades. A peculiar 'speckled' form of this berry was collected in Round and Flag glades.

"**Mammals.**

"Yellow-cheeked Meadow Mouse, **Microtus chrotorrhinus**. One specimen collected in July, 1909, on southern edge of glades by Fred E. Brooks. Not taken before south of Adirondack Mountains, New York.

"Masked Shrew, **Sorex personatus**. Common in open glades and about their borders.

"Smoky Shrew, **Sorex fumeus**. Less common.

"Red-backed Mouse, **Evotomys gapperi**. Most abundant in wooded border of glades.

"**Birds.**

"Alder Flycatcher, **Empidonax traillii alnorum**. Collected on margin of Big Glade by Earle A. Brooks.

"Swamp Sparrow, **Melospiza georgiana**. Seen in alder thickets.

"Magnolia Warbler, **Dendroica maculosa**. Common.

"Barred Owl, **Strix varia**. Abundant."

Destructive Fungi.

From "**An Annotated List of Fungi Destructive to Trees and Wood**", published on pages 82 to 86, of Volume V, of the Survey, with collections by Dr. John L. Sheldon, we list the following from Pocahontas County:

"**Pore Fungi.**

Coriolus abietinus (Dicks.) Quel.
On red spruce, Cranberry Glades.
Coriolus versicolor (L) Quel.
On birch, Cranberry Glades.
Coriolus prolificans (Fries) Murr.
On birch, Cranberry Glades.
On oak, Seebert.
Coriolus nigromarginatus (Schw.) Murr.
On dead wood, Cranberry Glades.
Daedalea confragosa (Bolt.) Murr.
On birch, Cranberry Glades.
Fomes roseus (Alb. & Schw.) Cooke.
On red spruce, Cranberry Glades.
Gloeophyllum hirsutum (Schaeff.) Murr.
On spruce log, (Alt. 4,000 ft.) Cranberry Mountain.
Grifola Berkeleyi (Fr.) Murr.
On dead wood, Cranberry Mountain.
Phaeolus sistotremoides (A. & S.) Murr.
On hemlock log, Cranberry Glades.
Polyporus fissus Berk.
On maple, Cranberry Glades.
Pyropolyporus igniarius (L.) Murr.
On birch, Cranberry Glades.
Pycnoporus cinnabrinus (Jacq.) Karst.
On dead wood, Cranberry Mountain.

"**Mildews.**

Erysiphe aggregata.
On alder, Durbin.

"**Miscellaneous.**

Hymenochaete tabacina.
On maple, Cranberry Glades.
Schizophyllum alveum.
On maple, Cranberry Glades.
Stereum complicatum.
On hemlock or spruce, Cranberry Glades.
Thelephora pedicellata.
On hawthorn, Durbin.
Gnomoniella fimbriata (Pers.) Sacc.
On Carpinus, Durbin.
Plowrightia morbosa (Schw.) Sacc.
On wild cherry, Cranberry Mountain.
Rhytisma ilicis-canadensis Schw.
On holly, Cranberry Glades."

Native Trees of Pocahontas County.

On pages 368 to 422 of Volume V of the Survey, A. B. Brooks lists "The Native Trees of West Virginia", from which the following list is taken showing those native to Pocahontas County:

Pinus strobus, L. White Pine.
Pocahontas: scattered trees and young groves on Knapp, Deer, and Sitlington Creeks, and on other eastern tributaries of the Greenbrier River.

Pinus rigida, Mill. Pitch Pine. "Bull Pine". "Rosin-tree".
Found locally on dry hills in Pocahontas County.

Pinus virginiana, Mill. Jersey Pine. Scrub Pine.
Pocahontas: few on Knapp Creek.

Picea rubens, Sarg. Red Spruce.
Confined to high mountains and plateaus. Grows at elevations varying from about 2,500 feet, in a few instances, up to 4,000 feet and over.

Pocahontas—on north and west—approximately 70,000 acres. According to Col. E. Hutton, whose estimate was published in Bulletin No. 17, of the West Virginia Agricultural Experiment Station (Dr. A. D. Hopkins, 1891), the area of spruce in West Virginia was 469,000 acres distributed as follows:

Randolph	140,500 acres.
Pocahontas	220,000 acres.
Tucker	50,000 acres.
Mineral	25,000 acres.
Greenbrier	33,500 acres.

In 1895 the area of standing spruce was estimated at 225,000 acres.

Tsuga canadensis, Carr. Hemlock.
A common timber tree. Grows in nearly all parts of the State. ****Most abundant in......Pocahontas......

Abies fraseri, Poir. Balsam Fir. She Balsam. "Blister Pine".
Pocahontas: a few trees scattered along the East Fork of Greenbrier River near its head, about 2 miles south of Big Sinks. A swamp containing about 40 acres was overgrown with this species until recently when the trees were nearly all cut down to improve the pasture.

Juniperus virginiana L. Red Cedar. Savin.
Not plentiful. Rarely found in......Pocahontas......

Juglans cinerea, L. Butternut. "White Walnut".
A common tree. Found throughout the State except on highest mountains and in a few small areas south and west, especially in Jackson, Putnam, Mingo, and Wyoming. Thrives at higher altitudes than Black Walnut, reaching 3,000 feet, or over, in its distribution along cold mountain streams in Randolph and adjacent counties.

Juglans nigra, L. Black Walnut.
Still found in scattered growth in rich coves, valleys, and hillsides in every county. Not found at high altitudes.

Hicoria minima, Britt. Bitternut. Swamp Hickory.
Infrequent. Found in rather small numbers in the following counties:............Pocahontas: Cranberry Glades.

Hicoria ovata, Britt. Shellbark Hickory. Shagbark Hickory.
A common tree. Found in all parts of the State except on high mountains.

Hicoria glabra, Britt. Pignut.
A common tree. Grows in every county in the State, but not frequent at high altitudes.

Populus tremuloides, Michx. Aspen. Quaking Asp.
Infrequent. Pocahontas: at Dunlevie (Thornwood), on the Greenbrier, and at Cranberry Glades.

Salix nigra, Marsh. Black Willow.
An abundant tree along streams throughout the State. Most common in the lower counties but found to some extent in almost every locality.

Carpinus caroliniana, Walt. Hornbeam. Blue Beech. "Water Beech".
A small abundant tree, distributed along streams and in moist ground throughout the State.

Ostrya virginiana, K. Koch. Hop Hornbeam. Ironwood.
Small tree. Frequent in thinly scattered growth throughout the State.

Betula lenta, L. Cherry Birch. Black Birch.
A common tree in the high hilly and mountainous counties of ....Pocahontas..........

Betula lutea, Michx. Yellow Birch. Gray Birch.
Frequent in the mountains. Grows with other hardwoods, but more often with spruce and hemlock, reaching the highest elevations above the sea from Grant and Tucker along the Alleghenies, and parallel lesser ranges, to Mercer and McDowell............This species prefers the highest parts of mountains where elevations are from 3,500 feet to 4,500 feet, and over, but is usually found in cool, damp ravines on the outposts of its range.

Betula nigra, L. Red Birch. River Birch.
Closely confined to borders of streams. Found along the following rivers:.........Greenbrier: from Hosterman, in Pocahontas, to Hinton, in Summers.

Fagus americana, Sweet. Beech.
Abundant in many parts of the State; found to some extent in every county.

Castanea dentata, Borkh. Chestnut.
Frequent throughout the State; most abundant and of largest size through the high hilly and mountainous sections, including portions of......... Pocahontas.........., and a few adjacent counties.

Quercus rubra, L. Red Oak.
Found throughout the State. Most frequent and of largest size in the high hilly and mountainous sections. Grows at higher elevations than the other native oaks.

Quercus coccinea, Moench. Scarlet Oak. "Pin Oak".
Grows on dry hills throughout the State. Not found in the higher mountains.

Quercus velutina, Lam. Black Oak. Yellow-bark Oak.
Distributed generally over the State. Abundant in scrubby growth on hills over the southern half of the State, where it is usually known as "Black Jack".

Quercus nana, Sarg. Bear Oak. Scrub Oak. "Jack Oak".
Principally east of the Alleghenies and the southern mountainous counties. Reported from Pocahontas and Greenbrier.

Quercus alba, L. White Oak.
One of the most widely distributed trees of the State. Found in every county and in almost every wooded locality except those of the highest elevations.

Quercus platanoides, Sudw. Swamp White Oak.
Infrequent. Pocahontas: few trees near Marlinton.

Quercus prinus, L. Chestnut Oak. Rock Chestnut Oak.
Common in all parts of the State except on the high mountains and plateaus.

Ulmus americana, L. White Elm.
Common in most parts of the State. Rarer in some parts of ....Pocahontas..........., and other mountainous counties. Confined to low land.

Ulmus fulva, Michx. Slippery Elm. Red Elm.
Distributed locally. Not found at high elevations.

Morus rubra, L. Red Mulberry.
Frequent throughout the State; found in scattered growth in every county, but nowhere abundant.

Magnolia acuminata, L. Cucumber-tree. Mountain Magnolia.
Scattered among other hard woods throughout the State. Most plentiful in the narrow rich valleys and slopes of the mountainous and high hilly sections.

Magnolia fraseri, Walt. Mountain Magnolia. Long-leaved Cucumber-tree.
Infrequent. Scattered through the mountainous parts of........ ....Pocahontas............... Found growing at elevation of 3,500 feet on head of North Fork of Cherry River in Pocahontas.

Liriodendron tulipifera, L. Yellow Poplar. Tulip-tree.
A common timber tree in nearly all parts of the State.

Asimina triloba, Dunal. Pawpaw.
Common. Scattered groves throughout the State. Rather infrequent in the mountainous counties and absent from the spruce belt, and adjacent highlands.

Sassafras sassafras, Karst. Sassafras.
Abundant, usually on thin dry land. Distributed throughout the State except at high altitudes.

Hamamelis virginiana, L. Witch Hazel.
Small abundant tree, found throughout the State.

Platanus occidentalis, L. Sycamore. Buttonwood.
Common throughout the State along nearly all streams below 3,000 feet elevation.

Malus coronaria, Mill. Crab Apple. Fragrant Crab.
A common tree in most sections......Abundant throughout the high hilly regions in the central and northern parts of the State.

Sorbus americana, Marsh. Mountain Ash.
Confined to high glades and mountains. Pocahontas: Cranberry Glades.

Amelanchier canadensis, T. & G. Shad Bush. Service Berry.
Frequent throughout the State. Most plentiful in damp rich soils in the mountainous and high hilly sections.

Crataegus punctata, Jacq. Large-fruited Thorn.
Plentiful at Durbin and Cass.

Prunus americana, Marsh. Wild Plum.
Borders of streams and glades. Thinly scattered over the State.

Prunus pennsylvanica, L. Wild Red Cherry. "Bird Cherry". "Fire Cherry".
Frequent in burnt lands at high elevations. Less common on lower ground.

Prunus serotina, Ehrh. Wild Black Cherry.
A common timber tree in the mountains. Once grew in great abundance in rich plateaus and mountain coves and valleys in parts of..........Pocahontas..........

Gleditsia triacanthos, L. Honey Locust.
Rather infrequent, along streams on both sides of the Alleghenies.

Robinia pseudacacia, L. Locust. Acacia. Yellow Locust.
Widely distributed. Frequent in every county, growing from the lowest elevations up to 3,500 feet and over.

Rhus hirta, Sudw. Staghorn Sumach.
A small tree. Common throughout the State, and reaching higher altitudes than the smaller shrubby species of this genus.

Acer spicatum, Lam. Mountain Maple.
Found in........Pocahontas........Grows from elevations of 850 feet in Monongalia to 4,800 feet in Pendleton.

PLATE LXVIII.—View in Big Glade, head of Cranberry River. (Photo. republished from page 332 of Volume V of the Survey).

PLATE LXIX.—Perry Mine on Beaver Lick Mountain, Pocahontas County. (Photo. republished from page 270 of Volume IV of the Survey).

PLATE LXX.—Natural blue grass sod on Cranberry Mountain, Pocahontas County. Land cleared by hacking and grazing. (Photo, republished from page 364 of Volume V of the Survey).

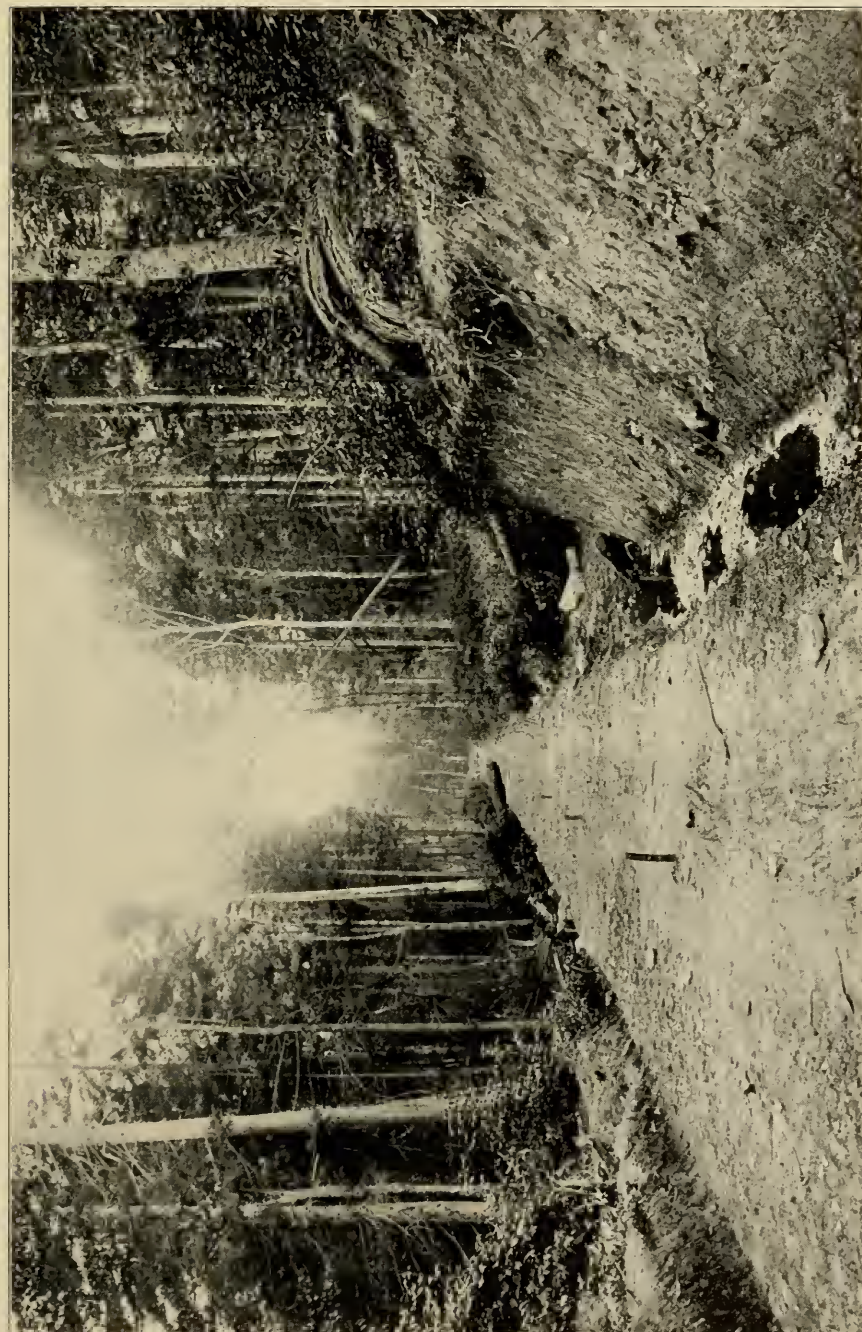

PLATE LXXI.—Grade for a lumber railroad near head of Cranberry River. (Photo. republished from page 68 of Volume V of the Survey).

Acer pennsylvanicum, L. Striped Maple. Moosewood.
Found with the foregoing species (Acer spicatum) but usually more abundant and in more shady situations.

Acer saccharum, Marsh. Sugar Maple. Rock Maple.
Found in every county. Superior on the elevated flats and in the rich coves along the Alleghenies from Tucker to Greenbrier and Monroe. Abundant in the high hilly sections just west of the mountains.

Acer rubrum, L. Red Maple. Scarlet Maple.
Occurs in all parts of the State. Not frequent in the counties east of the Allegheny Mountains.

Aesculus octandra, Marsh. Sweet Buckeye.
Found in........Pocahontas........ Variety, **hybrida**, Sarg., occurs more frequently than any other.

Tilia americana, L. Linden. Bass Wood.
Found at Cranberry Glades, Pocahontas County.

Nyssa sylvatica, Marsh. Tupelo. Pepperidge. "Black Gum."
A common tree throughout the State. Least frequent in the high mountains and in the counties east of the Alleghenies.

Cornus florida, L. Flowering Dogwood.
Frequent in all parts of the State.

Cornus alternifolia, L. Alternate-leaved Dogwood.
Found along the Allegheny Mountains and westward throughout the State. Infrequent on the east.

Diospyros virginiana, L. Persimmon.
Frequent on low lands throughout the State. Probably most abundant in the valleys of the several larger tributaries of the Potomac.

Fraxinus americana, L. White Ash.
Found throughout the State.

Viburnum prunifolium, L. Black Haw. Stag Bush.
A common small tree.

"List of Native Shrubs and Shrubby Vines.

The following list has been compiled from the list given on pages 422-7 of Volume V of the Survey under the above title:

Taxus canadensis, Marsh. American Yew. Ground Hemlock.
A rare red-berried evergreen. Pocahontas: Cranberry Glades and Winterburn.

Corylus americana, Walt. Hazelnut.
A common shrub.

Corylus rostrata, Ait. Beaked Hazelnut.
Pocahontas: Cranberry Mountain.

Alnus rugosa, (Du Roi), Spreng. Smooth Alder.
Abundant along streams.

Alnus incana, (L.), Moench. Hoary Alder (?).
Rare. Pocahontas: Cranberry Glades.

Aristolochia macrophylla, Lam. Pipe Vine. Dutchman's Pipe.
Woody vine. Frequent in rich mountain forests.

Benzoin aestivale, (L.) Nees. Spice-bush. Benjamin-bush.
Abundant shrub.

Hydrangea arborescens, L. Wild Hydrangea.
Abundant throughout the State.

Ribes cynosbati, L. Prickly Gooseberry.
Common in rocky woods.

Physocarpus opulifolius, (L.) Maxim. Nine-bark.
Common shrub.

Spiraea salicifolia, L. Meadow-sweet.
Pocahontas: Cranberry Glades.

Spiraea tomentosa, L. Hard-hack. Steeple-bush.
Infrequent. Pocahontas: Seebert.

Pyrus melanocarpa, (Michx.) Willd. Black Chokeberry.
Frequent, in many sections.

Amelanchier oligocarpa, (Michx.) Roem. (?) Oblong-fruited Juneberry.
Rare. Pocahontas: Cranberry Glades.

Rosa carolina, L. Swamp Rose.
Common in marshy places.

Rosa humilis, Marsh. Low or Pasture Rose.
Frequent in dry fields.

Prunus virginiana, L. Choke Cherry.
Rare. Pocahontas: Cranberry Glades.

Rhus copallina, L. Dwarf Sumach.
Frequent.

Rhus glabra, L. Smooth Sumach.
Common throughout the State.

Rhus toxicodendron var. radicans, L. Torr. Poison Ivy. Poison Oak.
Abundant throughout the State.

Ilex monticola, Gray. Large-leaved Holly.
A rather common shrub.

Ilex verticillata, Gray. Black Alder. Winterberry.
Abundant in low grounds along rivers and in glades.

Nemopanthus mucronata, (L.) Trel. Wild or Mountain Holly.
Rare. Pocahontas: head of Greenbrier River.

Evonymus americanus, L. Strawberry Bush.
A common shrub.

Celastrus scandens, L. Waxwork. Climbing Bitter-sweet.
Frequent along streams and on dry hills.

Rhamnus alnifolia, L'Her. Dwarf Alder.
Rare. Pocahontas: head of East Fork of Greenbrier River.

Vitis aestivalis, Michx. Summer Grape. Frost Grape.
Abundant in most sections.

Vitis cordifolia, Michx. Chicken Grape. Pigeon Grape.
A common grape.

Hypericum prolificum, L. Shrubby St. John's-wort.
Plentiful in glady regions.

Hypericum densiflorum, Pursh. St. John's-wort.
Glades.

Dirca palustris, L. Leatherwood. Wicopy.
Infrequent. Pocahontas: on Greenbrier River.

Cornus canadensis, L. Dwarf Cornel. Bunchberry.
A small shrubby plant. Rare. Pendleton: summit Spruce Knob; Randolph: near Osceola.

Cornus amomum, Mill. Silky Cornel. Kinnikinnick.
Frequent along streams.

Rhododendron maximum, L. Great Laurel. Rose Bay.
An abundant shrub, growing in thickets in many parts of the State.

Rhododendron viscosum, (L.) Torr. Clammy Azalea. White Swamp Honeysuckle.
Frequent along mountain streams.

Rhododendron nudiflorum, (L.) Torr. Purple Azalea. Pinxter Flower.
Abundant in many sections.

Rhododendron calendulaceum, (Michx.) Torr. Flame Azalea.
Common in many sections.

Kalmia latifolia, L. Mountain Laurel. "Ivy".
Abundant in thickets.

Andromeda glaucophylla, Link. (?) Bog Rosemary.
Rare. Pocahontas: Cranberry Glades. Plants not in bloom or fruit when collected.

Andromeda floribunda, Pursh. Mountain Fetter-bush.
Infrequent. Pocahontas: Green Bank. (Col. G. L. Swank).

Gaylussacia baccata, (Wang.) C. Koch. Black Huckleberry.
Abundant throughout the State.

Vaccinium staminium, L. Deerberry. Squaw Huckleberry. "Buckberry".
Abundant on dry ground.

Vaccinium vacillans, Kalm. Late Low Blueberry.
An abundant species.

Vaccinium oxycoccos, L. Small Cranberry.
In glades. Pocahontas and Tucker.

Vaccinium macrocarpon, Ait. Large or American Cranberry.
In glades. Pocahontas and Webster.

Viburnum alnifolium, Marsh. Hobble-bush. Moosewood, "Hobble-rod".
Abundant in mountain regions.

Viburnum acerifolium, L. Dockmackie. Arrow-wood.
A common shrub.

Viburnum dentatum, L. Arrow-wood.
Infrequent. Pocahontas: Cranberry Glades.

Sambucus canadensis, L. Common Elder.
Abundant throughout the State.

Sambucus racemosa, L. Red-berried Elder.
Frequent in rocky woods.

In Volume V(A) of the Survey, Part I, by C. F. Millspaugh, published in 1913, the Living Flora of West Virginia are described and listed. Several genera and species not listed in Volume V from which the preceding lists were compiled are given in this later volume, the Fungi covering pages 24-150; the Lichenes, pages 151-162; the Hepaticae, pages 163-172; the Musci, pages 173-190; the Pteridophyta, pages 191-8; the Gymnospermae, pages 199-389. This volume is still available and will be found of value to those interested in the flora of the State.

PART IV.

Paleontology.

CHAPTER XV.

NOTES ON PALEONTOLOGY, POCAHONTAS COUNTY.

By John L. Tilton.

The fossils herein listed were collected by Mr. Paul H. Price (and others) in the summers of 1926, 1927, and 1928, not for a complete list of fossils of the different formations, but as a series of local collections in some of which identification of species was needed to aid in mapping the stratigraphy. They illustrate the fossils that are common in the various formations. The data with reference to the different collections, as furnished by Mr. Price, are as follows:

Fossil Collections from Pocahontas County, W. Va. (Register of Localities by Lot Nos.)

1. Portage Series; Parkhead member; marine fossils; location, along highway (State route 43) 0.3 mile northwest of bridge across Browns Creek, 0.5 mile north of Huntersville; elevation, 2235′; stratigraphy, No. 31 of Knapp Creek Section, p. 106; collector, P. H. Price; description, p. 392.
2. Helderberg Series; Keyser member; marine fossils; location, 0.4 mile southeast of Huntersville along State road (No. 43); eleva-

tion, 2260′; stratigraphy, No. 37 of Knapp Creek Section, p. 106; collector, P. H. Price; description, pp. 398-9.

3. Clinton Series; Rochester Shale (of Maryland); marine fossils; location, 0.6 mile southeast of Huntersville along State road (No. 43); elevation, 2255′; stratigraphy, No. 47 of Knapp Creek Section, p. 107; collector, P. H. Price; description, pp. 401-2.

4. White Medina Series; marine fossils; location, 0.7 mile southeast of Huntersville along State road; elevation, 2255′; stratigraphy, No. 61 of Knapp Creek Section, p. 107; collector, P. H. Price; description, p. 402.

4A. Salina Series; Bossardville Limestone; marine fossils; location, 0.7 mile southeast of Huntersville along State road (No. 43); elevation, 2255′; collector, P. H. Price; description, pp. 399-400.

5. Chemung Series; marine fossils; location, along road 1 mile northwest of Rimel; elevation, 2400′; collector, P. H. Price; description, p. 387.

6. Greenbrier Series; Patton Limestone; marine fossils; location, along State highway 0.2 mile southwest of Edray; elevation, 2600′; stratigraphy, No. 73 of Edray Section, p. 95; collector, P. H. Price; description, pp. 378-9.

7. Greenbrier Series, Greenville Shale; 75′ to 85′ below top of Greenbrier; marine fossils; location, along State highway 1.1 miles northwest of Edray; elevation, 2900′; stratigraphy, No. 44 of Edray Section, p. 94; collector, P. H. Price; description, pp. 376-7.

8. Greenbrier Series; Greenville Shale; marine fossils; location, along State highway 1.1 miles northeast of Edray; elevation, 2915′; stratigraphy, No. 43 of Edray Section, p. 94; collector, P. H. Price; description, pp. 377-8.

8A. Greenbrier Series; Greenville Shale; marine fossils; location, along State highway, 1.1 miles northwest of Edray; elevation, 2915′; stratigraphy, Edray Section, p. 94; collector, P. H. Price; description, p. 378.

9. Mauch Chunk Series; Reynolds Limestone; marine fossils; location, along new State road (No. 24), 1.5 miles northwest of Edray; elevation, 3100′; stratigraphy, No. 30 of Edray Section, p. 94 and Local Measurement, p. 160; collector, P. H. Price; description, pp. 372-3.

10. Pocono Series; Broad Ford Sandstone; marine fossils; location, on road to Kee Flats, 1 mile southwest of Marlinton; elevation, 2300′; stratigraphy, No. 6 of Kee Flats Section, p. 97; collector, P. H. Price; description, pp. 379-80.

11. Genesee Series; marine fossils; location, along road at sharp curve 1 mile southwest of Browns Creek School; elevation, 2275′; collector, P. H. Price; description, pp. 394-5.

12. Niagara Series; McKenzie Formation; marine fossils; location, on branch of Browns Creek, along stream bed, 1 mile southwest of Mt. Tabor School; elevation, 2500′; stratigraphy, No. 16 of Rainbow Run Section, p. 108; collector, P. H. Price; description, pp. 400-1.

13. Hamilton Series; marine fossils; location, along highway 0.2 mile northeast of Westminster Church; elevation, 2375′; collector, P. H. Price; description, p. 396.

14. Genesee Series; marine fossils; location, on Knapp Creek, along highway 0.2 mile southwest of Westminster Church; elevation, 2375′; collector, P. H. Price; description, p. 395.

15. Genesee Series; marine fossils; location, along highway 0.8 mile south of Minnehaha Springs; elevation, 2335′; collector, P. H. Price; description, p. 395.

16. Genesee Series; marine fossils; along State road (No. 42), 0.4 mile southwest of Moore School; elevation, 2450′; collector, P. H. Price; description, pp. 395-6.

17. Mauch Chunk Series; Lillydale Shale; marine fossils; location, along State road (No. 24), 1.3 miles northwest of Edray; elevation, 3010'; stratigraphy, No. 37 of Edray Section, p. 94; collector, P. H. Price; description, pp. 374-5.

18. Mauch Chunk Series; Glenray Limestone; marine fossils; location, along new State road (No. 24) 1.3 miles northwest of Edray; elevation, 3040'; stratigraphy, No. 33 of Edray Section, p. 94; collector, P. H. Price; description, p. 374.

19. Greenbrier Series; Alderson Limestone (top); marine fossils; location, along new State road (No. 24) 1 mile northwest of Edray; elevation, 2970'; stratigraphy, No. 40 of Edray Section, p. 94; collector, P. H. Price; description, p. 375.

20. Marcellus Series; Onondaga Limestone; marine fossils; location, along highway 1 mile northwest of Frost or just east of Cove Hill School; elevation, 2625'; collector, P. H. Price; description, p. 397.

21. Pocono Series; Broad Ford Sandstone; marine fossils; location, along road to Linwood 1.5 miles west of Clover Lick; elevation, 2365'; collector, P. H. Price; description, pp. 380-1.

22. Pocono Series; Broad Ford Sandstone; marine fossils; location, on road to Kee Flats 1 mile southwest of Marlinton; elevation, 2300'; stratigraphy, No. 6 of Kee Flats Section, p. 97; collector, P. H. Price; description, p. 381.

23. Mauch Chunk Series; Reynolds Limestone; marine fossils; location, along second-class road in sharp curve 1 mile south of Spruce Flats School; elevation, 3100'; stratigraphy, Spruce Flats Section; collector, P. H. Price; description, p. 373.

24. Greenbrier Series; Alderson Limestone; marine fossils; location, along Staunton and Parkersburg pike 3 miles northwest of Durbin; elevation, 3375'; stratigraphy No. 22 of Durbin Section, p. 117; collector, P. H. Price; description, pp. 375-6.

25. Niagara Series; marine fossils; location, 1.2 miles southeast of Dilleys Mill and 0.3 mile northeast of Bethel School; elevation, 2775'; collector, P. H. Price; description, p. 401.

26. Chemung Series; upper portion; marine with some plant fossils; location, along Pocahontas-Pendleton County line, 1.5 miles southeast of The Pigs Ear; elevation, 3950'; collector, P. H. Price; description, pp. 387-8.

27. Hamilton Series; marine fossils; location, road ballast at Huntersville bridge; collector, P. H. Price; description, pp. 396-7.

28. Chemung Series; Valley Head Sandstone; plant fossils; location, along Knapp Creek, 4.5 miles southeast of Marlinton; elevation, 2200'; stratigraphy, Knapp Creek Section, p. 106; collector, P. H. Price; description, pp. 388-9.

29. Chemung Series; Valley Head Sandstone; plant fossils; location, along Knapp Creek, 4.5 miles southeast of Marlinton; elevation, 2200'; stratigraphy, Knapp Creek Section, p. 106; collector, P. H. Price; description, pp. 388-9.

30. Chemung Series; plant fossils; location, Laurel Creek, 0.2 mile west of Rimel; elevation, 2440'; collector, P. H. Price; description, p. 389.

31. Portage Series; twigs and plants; location, 0.6 mile north of Huntersville; elevation, 2235'; stratigraphy, Knapp Creek Section, p. 106; collector, P. H. Price; description, p. 392.

32. Greenbrier Series; Hillsdale Limestone; marine fossils; location, 0.5 mile northeast of Mill Point; elevation, 2300'; collector, P. H. Price; description, p. 379.

33. Mauch Chunk Series; Reynolds Limestone; marine fossils;

location, along State road (No. 24) on south end of Droop Mountain; elevation, 2640'; collector, P. H. Price; description, p. 373.

34. Red Medina Series; 200 to 250 feet below top; location, 0.8 mile southeast of Huntersville; elevation, 2260'; collector, P. H. Price; description, p. 403.

35. Chemung Series; Atrypa hystrix zone; marine fossils; location, 1 mile northwest of Huntersville; elevation, 2240'; stratigraphy, No. 30 of Knapp Creek Section, p. 106; collectors, I. C. White and P. H. Price; description, p. 390.

36. Pottsville Series; New River Group; plant fossils; location, Tumbling Rock Run, 1.5 miles northwest of Cranberry River; elevation, 3200'; collector, P. H. Price; description, p. 371.

37. Portage Series; Naples fauna; marine fossils; location, 0.2 mile south of road forks at Frost; elevation, 2560'; collector, P. H. Price; description, pp. 392-3.

38. Mauch Chunk Series; Reynolds Limestone; marine fossils; location, along road but 1.5 miles east of Gibson Knob; elevation, 3215'; collector, P. H. Price; description, p. 373.

39. Pocono Series; Sunbury Shale; marine fossils; location, along C. & O. R. R. 1 mile northeast of Marlinton; elevation, 2140'; stratigraphy, No. 1 of Fair-Grounds Section, p. 109; collector, P. H. Price; description, pp. 381-2.

40. Catskill Series; Saxton Shale; location, along C. & O. R. R., at the Fair-Grounds, 1.5 miles northeast of Marlinton; elevation, 2145'; stratigraphy, Fair-Grounds Section, p. 109; collector, P. H. Price; description, pp. 384-5.

41. Portage Series, Naples fauna; marine fossils; location, ¾ mile northwest of Frost; elevation, 2600'; collector, P. H. Price; description, pp. 393-4.

42. Chemung Series; Valley Head Sandstone; marine and plant fossils; location, 3.1 miles southeast of Marlinton; elevation, 2200'; stratigraphy, Knapp Creek Section, p. 106; collectors, David White, D. B. Reger, and P. H. Price; description, pp. 390-1.

43. Portage Series; Naples fauna; marine fossils; location, 1 mile south of Minnehaha Springs; elevation, 2350'; collectors, David White, D. B. Reger, and P. H. Price; description, p. 394.

44. Pocono Series; Sunbury Shale (top); marine and plant fossils; location, along C. & O. R. R. 1 mile northeast of Marlinton; elevation, 2140'; stratigraphy, No. 10 of Fair-Grounds Section, p. 109; collectors, David White, D. B. Reger, and P. H. Price; description, p. 382.

45. Catskill Series; Saxton Shale; marine fossils; location, along C. & O. R. R. at Fair-Grounds, 2 miles northeast of Marlinton; elevation, 2145'; stratigraphy, Fair-Grounds Section, p. 109; collectors, David White, D. B. Reger, and P. H. Price; description, pp. 385-7.

46. Pocono Series; Sunbury Shale; marine fossils; location, at Seebert; elevation, 2125' to 2150'; collectors, David White, D. B. Reger, and P. H. Price; description, p. 382.

47. Pocono Series; Sunbury Shale; marine fossils; location, in road 0.2 mile west of Buckeye Station; elevation, 2100' to 2125'; collectors, David White, D. B. Reger, and P. H. Price; description, pp. 382-3.

48. Pocono Series; Berea Sandstone; marine fossils; location at the Fair-Grounds, 1.5 miles northeast of Marlinton; elevation, 2145'; stratigraphy, Fair-Grounds Section, p. 109; collectors, David White, D. B. Reger, and P. H. Price; description, p. 383.

49. Salina Series; Bossardville Limestone; marine fossils; location, about 2 miles east of Dunmore, 1 mile northeast of Hillside School; elevation, 2600'; collector, P. H. Price; description, p. 400.

50. Chemung Series; marine fossils; collector, P. H. Price; description, p. 391.

51. Salina Series; Bossardville Limestone; marine fossils; location, 1 mile northwest of Frost; elevation, 2725'; collector, P. H. Price; description, p. 400.

52. Chemung Series; location, on State road (No. 43) along Knapp Creek, 4.5 miles east of Marlinton; elevation, 2200'; stratigraphy, No. 25 of Knapp Creek Section, p. 105; collector, P. H. Price; description, pp. 391-2.

53. Oriskany Series; Huntersville Chert; marine fossils; location, 0.5 mile northwest of Burr P. O.; elevation, 2750'; collectors, Andrew Price and P. H. Price; description, pp. 397-8.

54. Helderberg Series; Keyser member; marine fossils; location, (Glade Hill), along Thorny Branch, 1.5 miles northeast of Hillside School; elevation, 2600'; collectors, Andrew Price and P. H. Price; description, p. 399.

55. Greenbrier Series; Alderson Limestone; marine fossils; location, along new State road (No. 24) above Edray; elevation, 2950'; stratigraphy, Edray Section, p. 94; collectors, Andrew Price and P. H. Price; description, p. 376.

56. Mauch Chunk Series; Reynolds Limestone; marine fossils; location, along new State road (No. 24) above Edray; elevation, 3040'; stratigraphy, Edray Section, p. 94; collectors, Andrew Price, Calvin Price, Ed. Moore, and P. H. Price; description, pp. 373-4.

59. Pocono Series; Sunbury Shale; marine fossils; location, 1.25 miles southwest of Clover Lick; elevation, 2420' B.; collector, P. H. Price; description, p. 383.

60. Mauch Chunk Series; Hinton Group; marine fossils; location, 2.25 miles northwest of Stony Bottom, near head of Elklick Run; elevation, 4200'; stratigraphy, No. 10 of Elklick Run Section, p. 102; collector, P. H. Price; description, p. 372.

61. White Medina Series; location, east side of Beaver Lick Mountain along Cummins Creek; collector, P. H. Price; description, pp. 401-2.

62. Catskill Series; Saxton Shale; marine fossils; location, State road (No. 56) on Back Allegheny Mountain 1 mile west of Durbin; collector, D. B. Reger; description, p. 387.

63. Genesee Series; marine fossils; location, State road (No. 42) on north side of Knapp Creek, at Mill Run, 2 miles southwest of Frost; collector, D. B. Reger; description, p. 396.

64. Oriskany Series; Huntersville Chert (top); marine fossils; location, Knapp Creek, 1.5 miles southwest of Frost; collector, D. B. Reger; description, p. 398.

In the "Distribution of Collections by Geologic Formations", the geologic sequence is followed beginning at the top, to conform to the plan adopted in other county reports of the Survey. The numbers in the table are the collection (Lot) numbers that Mr. Price had assigned to the collections made in the various formations. In the report that follows this list the collections are considered in the order seen in this table.

Distribution of Collections by Geologic Formations.

Pennsylvanian System.
- Pottsville Series.
  - New River Group, No. 36.

Mississippian System.
- Mauch Chunk Series.
  - Hinton Group, No. 60.
  - Bluefield Group.
    - Reynolds, Nos. 9, 23, 33, 38, 56.
    - Glenray, No. 18.
    - Lillydale Shale, No. 17.
- Greenbrier Series.
  - Alderson, Nos. 19, 24, 55.
  - Greenville Shale, Nos. 7, 8, 8A.
  - Patton, No. 6.
  - Hillsdale, No. 32.
- Pocono Series.
  - Broad Ford, Nos. 10, 21, 22.
  - Sunbury, Nos. 39, 44, 46, 47, 59.
  - Berea, No. 48.

Devonian System.
- Upper Devonian.
  - Catskill Series.
    - Saxton, Nos. 40, 45, 62.
  - Chemung Series, Nos. 5, 26, 28, 29, 30, 35, 42, 50, 52.
  - Portage Series, Nos. 1, 31, 37, 41, 43.
  - Genesee Series, Nos. 11, 14, 15, 16, 63.
- Middle Devonian.
  - Hamilton Series, Nos. 13, 27.
  - Marcellus Series.
    - Onondaga, No. 20.
- Lower Devonian.
  - Oriskany Series.
    - Huntersville Chert, Nos. 53, 64.
  - Helderberg Series.
    - Keyser, Nos. 2, 54.

Silurian System.
- Salina Series.
  - Bossardville, Nos. 4A, 49, 51.
- Niagara Series.
  - McKenzie, Nos. 12, 25.
- Clinton Series.
  - Rochester (of Maryland), No. 3.
- White Medina Series, Nos. 4, 61.
- Red Medina Series, No. 34.

PENNSYLVANIAN.

POTTSVILLE SERIES.

NEW RIVER GROUP (OR TOP OF MAUCH CHUNK).

No. 36.—Location: Tumbling Rock Run, 1.5 miles northwest of the forks of Cranberry River, at elevation of 3200 feet.

Matrix: A coarse, light-colored sandstone of rounded quartz grains cemented with quartz and limonite. The fossils are thinly encrusted with limonite.

Fossils: The fossils are of two types: First, There are seven fragments with flattened stems. The largest stem is 18.5 cm. long, extending from the tip of the stem back to where the stem is 4.0 cm. by 1.5 cm. with impressions of 45 fibrovascular bundles. These impressions do not alternate at the nodes, but run straight through. There are three other fragments that include the tips of branches. In one of these the seventh segment from the tip has 36 fibrovascular impressions. One fragment of rock has six pieces of stem closely packed. Second, There are five casts of fruit and three impressions of fruit. The most perfect cast is oval in lengthwise section and nearly circular in cross-section; length 1.8 cm., diameter 0.9 x 1.2 cm. It contains three faint lines as of **Trigonocarpus**, but they are not equally spaced. The other fruit casts are of approximately the same size as this one.

Comment: Apparently the fossils came from the Pottsville rather than from the Mauch Chunk.

The impressions of internal fibrovascular bundles do not alternate at the nodes, as in **Calamites**, but lie end to end, like the external ribs of **Sphenophyllales**. The singular fact is the close association of seed-like bodies with these tips of stems. Is it possible that in these specimens of stems and fruit we have evidence of a relation between the **Sphenophyllales** and the **Cycadofilices**?

The specimens are casts only, without petrifaction, and there is no direct union of the fruit with the stems associated with them.

MISSISSIPPIAN.

MAUCH CHUNK SERIES.

HINTON GROUP.

No. 60.—Location: 2.25 miles northwest of Stony Bottom, near head of Elklick Run, at elevation of 4200 feet.

Matrix: A soft, dark-gray, almost black, calcareous shale.

Fossils:

Edmondia sp.
Allorisma sp. (very abundant)
Sphenotus sp.
Myalina sp.

Comment: We are informed that this collection was secured in the Hinton Group, well above the lowest shales of the Mauch Chunk. Descriptions of the new species in that group are not at present available. The genera here named are found in various shales of the Mauch Chunk.

BLUEFIELD GROUP.

Reynolds Limestone.

No. 9.—Location: 1.5 miles northwest of Edray, along new State road (No. 24), at elevation of 3100 feet.

Matrix: A dark-colored limestone from which the fossils received are largely weathered out.

Fossils:

Crinoid stems
Orthotetes kaskaskiensis
Orthotetes keokuk
Productus ovatus
Diaphragmus elegans
Spirifer pellaensis
Spiriferina spinosa
Composita trinuclea
Composita subquadrata
Allorisma clavata
Straparollus planidorsatus
Goniatites striatus ?

Comment: The Reynolds Limestone has an **Orthotetes** horizon. In this collection **Orthotetes** is especially abundant.

So, too, are **Composita subquadrata** and **Spirifer pellaensis.**

No. 23.—Location: Along second-class road one mile south of Spruce Flats School, in sharp curve, at elevation of 3100 feet.

Matrix: A dark-gray limestone, fossiliferous, containing rounded chert pebbles.

Fossils:

Fenestella
Crinoid stems
Productus ovatus
Spirifer pellaensis
Spiriferina spinosa
Composita subquadrata.

No. 33.—Location: Along State road (No. 24) on south end of Droop Mountain in Greenbrier County, at elevation of 2640 feet.

Matrix: There is a small fragment of bluish calcareous shale. With it is a fragment of weathered light-brown calcareous shale and three small fossils weathered out.

Fossils:

Chonetes sp.
Leda bellistriata
Bellerophon sp.
Pelecypod sp.

Comment: These fossils mark a shale in the Reynolds Limestone.

No. 38.—Location: 1.5 miles east of Gibson Knob, along road, at elevation of 3215 feet.

Matrix: The fossils are nicely weathered out of a dark limestone.

Fossils:

Zaphrentis spinulosa
Orthotetes kaskaskiensis
Productus ovatus
Diaphragmus elegans
Spirifer pellaensis
Composita trinuclea
Composita subquadrata
Straparollus planidorsatus.

No. 56.—Location: Along new State road (No. 24) above Edray, at elevation of 3040 feet.

Matrix: A very dark-gray limestone. Nine of the ten fossils are weathered out.

Fossils:

Orthotetes keokuk
Spirifer pellaensis
Composita subquadrata
Composita trinuclea
Fish teeth (Psammodus).

Comment: One tooth is of irregular shape, with surface approximately 1 cm. x 0.6 cm., rounded and smooth except as minutely pitted where the ends of ducts from below reach the surface. The other of the two teeth has the same general shape and markings, with length of 0.6 cm. These are the pavement teeth of a conchifragous shark, apparently of the genus **Psammodus.**

Glenray Limestone.

No. 18.—Location: 1.3 miles northwest of Edray, along State road (No. 24), at elevation of 3040 feet. The collection was obtained 50 feet below the Reynolds Limestone.

Matrix: A light-gray calcareous shale, somewhat micaceous, very fossiliferous, weathering brown.

Fossils:

Fenestella sp.
Productus ovatus
Spirifer pallaensis
Spiriferina spinosa
Composita subquadrata.

Lillydale Shale.

No. 17.—Location: 1.3 miles northwest of Edray, along State road (No. 24), at elevation of 3010 feet. The collection was obtained 80 feet below the Reynolds Limestone.

Matrix: A dark-gray fossiliferous limestone with brownish partings and weathered surface.

Fossils:

Fenestella sp.
Bryozoa (branching)
Crinoid stems and plates
Productus ovatus
Spirifer pellaensis
Spiriferina spinosa
Eumetria vera
Composita subquadrata
Nucula sp.

Comment: The measurement in the section places this limestone in the Lillydale. Such a limestone facies is not found in the northern part of the State. Evidently there occurs in Pocahontas County a limestone with a fossil content like that of the Glenray. It lacks **Allorisma clavata** and other pelecypod forms.

GREENBRIER SERIES.

Alderson Limestone.

No. 19.—Location: One mile northwest of Edray, along State road (No. 24), at elevation of 2970 feet, at top of the limestone.

Matrix: A dark-gray limestone, from which the fossils are largely weathered out.

Fossils:

Zaphrentis (three species)
Stenopora sp.
Archimedes (zoaria) ?
Fenestella sp.
Pentremites sp.
Talarocrinus ?
Orthotetes kaskaskiensis
Productus ovatus
Diaphragmus elegans
Echinochonchus alternatus
Spirifer pellaensis
Spiriferina spinosa
Cliothyridina sublamellosa
Composita trinuclea
Phillipsia (pygidium) sp.

Comment: No axial portions of **Archimedes** are present, but in some of the fenestrated expansions the zooecia are very small. These are thought to belong to **Archimedes,** while the larger zooecia are assigned to **Fenestella.** Of the **Composita** some are small and spherical. It is possible that these may be **C. globosa** instead of forms of **C. trinuclea.**

No. 24.—Location: Three miles northwest of Durbin, along the Staunton and Parkersburg Pike, at elevation of 3375 feet.

Matrix: A dark-gray limestone from which a number of fossils are weathered out.

Fossils:

Productus ovatus
Diaphragmus elegans (abundant)
Spirifer pellaensis

Cliothyridina sublamellosa ?
Composita trinuclea
Composita subquadrata.

No. 55.—Location: Along the new State road (No. 24) above Edray, at elevation of 2950 feet.

Matrix: The collection consists of two pieces of dark-gray limestone.

Fossils:

Coral (minute) sp.
Crinoid stems
Productus ovatus
Diaphragmus elegans
Spirifer pellaensis
Spiriferina spinosa
Cliothyridina sublamellosa
Archimedes sp.
Stenopora sp.

Comment: No axial portion of **Archimedes** is evident, but parallel bands of the fenestrated portion are conspicuous, and scattered through the limestone are numerous portions of minute zooecia. Along with these portions are larger zooecia which here appear to be portions of **Archimedes.** **Stenopora** occurs in thin sheets of zooecia with columnar walls. Of brachiopods there are only a few fragments, but these have peculiarities that render the identification satisfactory. **Platycrinus penicillus (huntsvillae)** is not found among the fragments of crinoids.

Associated with the above is a flattened and partly rounded black horny shell or stem about 1.6 cm. long, with faint annulations and with fine circular lines of growth.

Greenville Shale.

No. 7.—Location: Northwest of Edray 1.1 miles, at elevation of 2900 feet, 75 to 85 feet below the top of the Greenbrier Limestone.

Matrix: A very dark limestone, greatly weathered and very fossiliferous.

Fossils:

Stenopora sp.
Fenestella sp.
Rhombopora sp.
Crania sp.

Orthotetes kaskaskiensis
Chonetes illinoisensis
Productus ovatus
Diaphragmus elegans
Spiriferina spinosa.

The following identifications are less positive because of imperfection of material:

Zaphrentis pellaensis ?
Eumetria marcyi ?
Girtyella ?
Parallelodon ?

Comment: **Crania** is not mentioned in either the collection from the type locality of the Alderson Limestone or the collection from the type locality of the Union. **Rhombopora, Orthotetes kaskaskiensis, Spiriferina spinosa, Eumetria marcyi,** and **Parallelodon** are reported from the Alderson only, and **Chonetes illinoisensis** is mentioned from the Union (also from the Burlington and Keokuk). The other forms are reported as found both in the Alderson and in the Union. The results thus express close faunal relation with the Alderson. The collection does not contain **Caneyella.**

No. 8.—Location: Northwest of Edray 1.1 miles, at elevation of 2915 feet, 55 to 75 feet below the top of the limestone.

Matrix: Part is a calcareous shale and part is a weathered limestone, both with the same kinds of fossils.

Fossils:

Fenestella sp.
Crinoid stems
Orthotetes kaskaskiensis
Chonetes illinoisensis
Spirifer pellaensis
Spiriferina spinosa.

Comment: **Chonetes illinoisensis** and **Spirifer pallaensis** are both abundant in the collection. **Spiriferina spinosa** is the only one listed among fossils found in the Alderson Limestone, type locality, and not reported from the type localities below. **Orthotetes kaskaskiensis** is listed among fossils found at the type locality of the Alderson Limestone and not listed among fossils found at the type localities of the next two formations below (Greenville and Union).

No. 8A.—Location: Northwest of Edray 1.1 miles, at elevation of 2915 feet.

Matrix: A little dark clayey calcareous shale is still clinging to the specimen.

Fossils: These consist of two fragments of pavement teeth of a conchifragous shark. One tooth is nearly complete. It is 4.5 cm. long, 2.5 cm. wide, and 1 cm. thick, nearly rectangular in outline. The surface is convex, with axis of convexity parallel to the length of the tooth, and with steeper slope on one side than on the other. It is marked by minute irregular pits which lie at the end of ducts reaching up from the irregular network of ducts below. Otherwise the surface is smooth and rounded. The bottom and one side are concave. The tooth appears to belong to a shark of the genus **Psammodus**. The other piece is a fragment of the same kind of a tooth. The surface dimensions are 1.7 cm. x 1.5 cm. The thickness is 1 cm.

Patton Limestone.

No. 6.—Location: 0.2 mile southwest of Edray, at elevation of 2600 feet.

Matrix: A light-gray limestone, fossiliferous. Some of it is argillaceous.

Fossils:

Zaphrentis sp.
Crinoid stems
Stenopora sp.
Chonetes (two species)
Productus ovatus
Spirifer pellaensis
Spiriferina cf. subelliptica
Composita trinuclea.

Comment: In the above **Zaphrentis, Composita trinuclea,** and **Spirifer pellaensis** were found in the limestone, and the others, together with **Spirifer pellaensis,** were found in the soft material (shale?). As in the lists given for the type localities, **Productus ovatus** and **Stenopora** are reported from the shale only, the question is raised: Is not the collection a combined collection from both the Patton Shale and the Patton Limestone?

Hillsdale Limestone.

No. 32.—Location: 0.5 mile northeast of Mill Point, at elevation of 2300 feet.

Matrix: The material is largely a mass of silicified fossils, chiefly of **Lithostrotion canadense (mammillare)** in chert. A smooth section of the solid chert reveals an abundance of crinoid stems, bryozoa, and fragments of brachiopod shells massed in together. There is but one fragment of the rock that is calcareous. That fragment is a fine-grained, light-brown, weathered limestone containing **Allorisma.**

Fossils:

Lithostrotion canadense (mammillare)
Lithostrotion proliferum
Batostomella sp.
Fenestella (two species)
Crinoid stems
Echinochonchus sp.
Orthotetes kaskaskiensis
Productus ovatus
Productus sp.
Cliothyridina sublamellosa
Allorisma sp.

Comment: **Lithostrotion canadense** is in abundance, while of **L. proliferum** there is but a single specimen. **L. canadense** is reported from the Hillsdale only (St. Louis) but **L. proliferum** extends into the beds (Ste. Genevieve) above.

POCONO SERIES.

Broad Ford Sandstone.

No. 10.—Location: 1 mile southwest of Marlinton on road to Kee Flats, at elevation of 2300 feet.

Matrix: A brownish-red, fine-grained sandstone with fossil horizon from which the shells have been entirely removed by solution, leaving impressions of them in the sandstone.

Fossils: The surface of the specimen is a mass of pelecypod and gastropod impressions, most of which are fragments. Two forms are perfect enough to recognize. One corresponds to **Palaeoneilo concentrica**; the other is a small **Platyceras** sp. about 2 mm. in diameter. Of the various fragments one suggests a pelecypod and another a brachiopod, but further than that the material is too fragmentary for identification.

Comment: The Pocono fauna is at present not well described. George H. Girty recognizes Devonian characteristics, even though on the whole Mississippian characteristics prevail. The latter are especially noteworthy in descriptions of the New Providence Shale in Kentucky, and in the Mercer, Monroe, and Summers Report of the West Virginia Geological Survey. The fossils found in collection No. 10 are not distinctive, for both **Palaeoneilo** and **Platyceras** range through both the Devonian and the Mississippian. However, **Palaeoneilo concentrica** is a Pocono form. Further than that, there is a complete lack of the species which are found in abundance among Chemung fossils. The absence of such forms is very significant, which, coupled with an abundance of gastropods unaccompanied by fish and plant remains, excludes the Chemung with certainty and seems also to exclude the Catskill. There is thus here an unusual absence of forms that are hold-overs into the Mississippian.

No. 21.—Location: Along road to Linwood, 1.5 miles west of Clover Lick, at elevation of 2365 feet (60 feet above base of Berea).

Matrix: This is a light-brown and greenish, fine-grained sandstone, non-calcareous, very fossiliferous.

Fossils:

Orthotetes kaskaskiensis ?
Camarotoechia ?
Spirifer increbescens
Modiomorpha subangulata
Platyceras sp.

Comment: The pieces of sandstone contain a mass of impressions of **Spirifer increbescens**, with impressions of parts of shells that seem to be **Orthotetes, Camarotoechia**, and **Platyceras.**

The **Spirifer** is closely related to **Spirifers** found in the Chemung **(S. mesacostalis)**, so that, with the varying degrees of perfection, the assemblage is wonderfully Chemung-like; but there is a complete absence of **Spirifer disjunctus** and **Atrypa hystrix.**

No. 22.—Location: On the road to Kee Flats, 1.0 mile southwest of Marlinton, at elevation of 2300 feet.

Matrix: This is a light-brown, fine-grained sandstone stained with limonite. It is very fossiliferous, but all shell material has been dissolved away, leaving only impressions of the fossils.

Fossils: Two types of shells are very abundant. One is that of a pelecypod, **Palaeoneilo concentrica**, the other, that of a gastropod, **Platyceras** sp. There are also several indefinite impressions of parts of shells.

Comment: In character of matrix and of fossils this specimen (No. 22) is identical with No. 10.

Sunbury Shale.

No. 39.—Location: 1.0 mile northeast of Marlinton, along the Chesapeake and Ohio Railway, at elevation of 2140 feet.

Matrix: There are two types of matrix. One is of dense, greenish-gray, fine-grained sandstone, thin-bedded (flaggy), non-calcareous, and slightly micaceous. The other type is shaly and somewhat brecciated.

Fossils: There are numerous short fragments that seem to be impressions of algae. There are also long narrow striated impressions that correspond to impressions of **Calamites.**

The most distinct impression of a shell is that of a low conical shell somewhat oval in shape and 12 mm. long, with concentric lines of growth. The center has been damaged, so that proof is wanting as to whether the shell is that of **Orbiculoidea.** What is left does not indicate a break near enough to the margin for **Lingulidiscina.** Forms similar to this one are recognized in the Chemung (**Lingula melie**) and also in the Cuyahoga of the Mississippian (**Orbiculoidea pulchra**). A second form is that of a portion of a pelecypod that suggests a **Palaeoneilo.** There are also impressions of portions of brachiopods somewhat like **Camarotoechia,** but too meager for use. The fossils thus do not give definite information as to the exact horizon of the location, nor add to the knowledge of the fauna.

No. 44.—Location: 1 mile northeast of Marlinton, along the Chesapeake and Ohio Railway, at elevation of 2140 feet.

Matrix: A dark, fine-grained sandstone, with an abundance of marcasite and with black cherty concretions; fossiliferous.

Fossils: The best specimens are of **Orbiculoidea** with characteristics corresponding to those of **sampsoni.** There are also **Lingulidiscina newberryi,** a small pedicle valve that seems to be **Chonopectus fischeri,** though the weathered impression in the sandstone does not present the cross markings of that genus. There are numerous markings as of compressed **Camarotoechia** sp. There are two valves corresponding to **Palaeoneilo concentrica** (?) and impressions of a gastropod-like form preserved in marcasite; and another form that has the external shape of an **Orthoceras** (length 17 mm., average diameter 2 mm.).

No. 46.—Location: Seebert, at elevation of 2125 to 2150 feet.

Matrix: A dark, fine-grained sandstone, somewhat micaceous.

Fossils: This single small specimen contains **Lingulidiscina newberryi,** portions of **Lingula melie,** a small impression as of **Chonetes,** and a fragment of **Calamites.**

No. 47.—Location: In road 0.2 mile west of Buckeye Station, at elevation of 2100 to 2125 feet.

Matrix: A dense, fine-grained, dark-gray, non-calcareous sandstone, fossiliferous.

Fossils: There are two fragments of **Calamites,** a portion of a large flat brachial valve that appears to be of **Orthotetes keokuk** and another small fragment of an **Ortho-**

tetes. There are also two species of a **Camarotoechia**, and one each of **Chonetes, Rhipidomella**, a small pelecypod, and a small gastropod.

Comment: The rock is not of the character of the other material reported from the Sunbury Shale. It lacks **Lingula melie, Orbiculoidea**, and **Lingulidiscina**, which are characteristic of the Sunbury Shale. **Orthotetes keokuk** has been found in the Logan Series, which lies considerably above the Sunbury, but it is not reported from the Sunbury, nor from the Berea. This makes it appear that the stratum from which the collection was derived lies above the Sunbury. The other specimens are not complete enough to fix the determination of horizon.

No. 59.—Location: 1.25 miles southwest of Clover Lick.

Matrix: A brown, fine-grained, fossiliferous sandstone, non-calcareous, but full of impressions of fossils; 30 feet above base of Pocono.

Fossils:

Crinoid stem (impression of one segment)
Orthotetes kaskaskiensis
Chonetes sp.
Camarotoechia sp.
Spiriferina spinosa
Spirifer increbescens
Platyceras sp.
Gastropod, low spire
Gastropod, medium spire.

Comment: In this list **Orthotetes, Spiriferina**, and **Spirifer increbescens** emphasize the Mississippian. The strata are evidently above the Berea and apparently in the Sunbury.

Berea Sandstone.

No. 48.—Location: At the Fair-Grounds, 1.5 miles northeast of Marlinton, at elevation of 2145 feet.

Matrix: There are two small fragments of greenish argillaceous shale from "near the middle of the Berea".

Fossils: There are numerous specimens of **Lingula**. One is 12 mm. long and 5.5 mm. wide. Another is 6 mm. long and 3.15 mm. wide.

DEVONIAN.

CATSKILL SERIES.

Saxton Shale.

No. 40.—Location: At the Fair-Grounds 1.5 miles northeast of Marlinton, along the Chesapeake and Ohio Railway, at elevation of 2145 feet.

Matrix: A greenish-gray, shaly sandstone, micaceous and somewhat finely arenaceous; non-calcareous.

Fossils:

Protolepidodendron.

Comment: One of the fragments, 3.5 cm. x 2.5 cm. x 1 cm., contains very significant imprints. Around one side of the fragment are impressions of a twig, upon one side of which are elongated impressions, in the midst of which are several dots as of emerging nerve traces, evidently like those which a little to the right form a distinct line, the outer covering there having been removed. Around the margin and upon the other side of the specimen are to be seen other similar rows and between them long strands as of fibrovascular bundles. One-half centimeter from the upper or outer end of the specimen is a leaf extension 3 mm. long that seems to reach out from a nerve trace. Near the other end of the specimen there are other radiating fibrovascular strands which appear to have branched from the stem, but if they were so related the former union is now broken away. Nothing of the interior is preserved, that portion now consisting of micaceous sandstone of the general type of the matrix. The impressions outlined in the matrix are stained by brownish limonite, and in other places are to a less extent marked by carbonized fragments. Clearly this little specimen presents the characteristics of a **Protolepidodendron**, one of the earliest known lepidophytes, the characteristics of which are so fully described and illustrated by Dr. David White.[1]

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[1]David White: A Remarkable Fossil Tree Trunk. N. Y. State Museum, Bull. No. 107, Geology 12, pp. 327-340; 1907.

See also E. W. Berry: Devonian Floras. Am. Jour. of Sci., Fifth Series, No. 80, Vol. 14, pp. 109-120; Aug., 1927.

In other fragments of this material there are also to be seen two types of impressions of fibrovascular bundles of stems and leaves. One consists of an elongated linear arrangement of fibrovascular bundles, the other of an expanding and radiating arrangement with rounded outer margin (tip). These are closely associated, but it can not be said that the radiating portion branches out from the elongated portion. While lepidophytic in appearance there is nothing else present that leads to more definite classification.

Still another fragment also presents a striking arrangement: a portion suggesting a fragment of a strobus is situated in an angle (axil) between the fibrovascular bundles of a stem and a near-by curved portion as of a bract.

No. 45.—Location: At Fair-Grounds, 2 miles northeast of Marlinton, along Chesapeake and Ohio Railway, at elevation of 2145 feet.

Matrix: An irregularly bedded, non-calcareous, iron-stained shale, with an abundance of carbonaceous material and with crystals of gypsum. An analysis by Dr. B. B. Kaplan, Chemist of the Survey, gives 4.06 per cent. of phosphate.

Fossils: The fossils represent five general types: plants, **Lingula,** fish bones, scales, and coprolites.

Plants.—The plant remains are chiefly flat indeterminate linear leaf-like impressions, longitudinally ribbed as by fibrovascular bundles.

Lingula.—There are three specimens of **Lingula**-like forms with distinct lines of growth. One is 7 mm. long and 4 mm. wide (oval). Another is 6 mm. long and 3.5 mm. wide. The third is somewhat smaller than the other two. These suggest brackish-water conditions.

Fish.—Scattered all through the material are impressions of ornamented surfaces of cephalic bone plates. Some of the ornamentation is in the form of pits and knobs; some in the form of irregular rounded ridges, and some in the form of fine regular wavy markings. With these fragments of plates are other bones. Some are smooth and evenly rounded as of dentary bones, some are cylindrical rods of bony structure, and others are fragments of angular bones.

There are also numerous scales, of three general types: one oval, another rhombic, nearly square, and a third triangular. One oval form is 12 mm. long and 10 mm. wide. Most of the surface is ornamented with small rounded particles. Near an edge where the granules are absent there is faint evidence of radial striation. Beneath one scale is the ornamented surface of a bone. One of the rhombic forms, nearly square, is 1.5 mm. x 1.5 mm., with smooth surface. Others are with undulatory surface. In the triangular forms the outer margin is rounded, and the surface corrugated, some coarsely and some fine. These forms are of a glistening black (thin enamel?). In one form a point is prolonged as for attachment.

Tooth.—There is one straight conical tooth, length 5.5 mm., diameter at base 2 mm. For about two-thirds of its length from the base it is corrugated. The tip is smooth.

Coprolites.—There are various dark nodular masses. The best and largest of these is 8 mm. in length and 4 mm. in diameter, with faint evidence of a spiral form. It is blotched with dark particles.

Comment: It is hardly possible that all these fragments are portions of the same kind of fish, even though there may be plates on the head and smaller scales on the rest of the body. The scales are of different types: oval, rhombic, somewhat triangular, smooth, imbricated; and the one tooth is a strong conical tooth.

Thus far but two types of fish are reported from the Catskill[2] of Ohio. One is **Holoptychius**, with imbricated scales, the other **Bothriolepis**. The conical tooth also corresponds to one from a ganoid, as of **Holoptychius**.

From the numerous fragments it is evident that these beds should be examined as fully as possible in hopes of finding complete forms as well as fragments. Only half a mile away sandy shale of about the same horizon afforded **Protolepidodendron**. Fish remains seem to have accumulated in a

[2]J. S. Newberry: Descriptions of Fossil Fishes. Geological Survey of Ohio, Vol. I, part 2, pages 271-276. See also Monograph 16, U. S. Geol. Survey, pp. 106-120; 1889; where three other types of evidence are mentioned that do not seem to fit here.

shallow body of brackish water which may have dried up, for gypsum crystals are in the deposit.

No. 62.—Location: State road (No. 56) on Back Allegheny Mountain 1.0 mile west of Durbin.

Matrix: A medium-grained, light-brown sandstone with small flakes of mica.

Fossils:

Scale of **Holoptychius.**

Comment: The scale is nearly circular, 2 mm. in diameter, with center of growth eccentric, (0.7 cm. from one margin and 1.3 cm. from opposite margin), with distinct lines of growth (concentric), and with fine radiating corrugations which in the distal quarter of the scale develop into eight large corrugations. (See report on fish in No. 40).

CHEMUNG SERIES.

No. 5.—Location: Along road 1 mile northwest of Rimel, at elevation of 2400 feet.

Matrix: A fine-grained, grayish sandstone stained brownish by limonite. It is porous and contains many cavities, mostly thin, where shells have been removed by solution.

Fossils:

Sponge markings on shell
Bryozoa (branching)
Liparocrinus halli
Crinoid stems
Douvillina cayuta
Atrypa hystrix (abundant)
Spirifer disjunctus (abundant).

Comment: The horizon is in the upper part of the Chemung.

No. 26.—Location: Along the Pocahontas-Pendleton County line 1.5 miles southeast of "The Pigs Ear", at elevation of 3950 feet.

Matrix: A fine-grained, grayish-brown sandstone, porous, and with numerous cavities where shells have been dissolved out. In fresh breaks these cavities are found stained by dark-brown limonite.

Fossils:

Leaves of plants
Crinoid stems
Atrypa hystrix
Douvillina cayuta
Leptostrophia perplana var. nervosa
Productella lachrymosa
Palaeanatina angusta
Holopea ?

Comment: In this list perhaps the most noteworthy facts are the absence of **Spirifer disjunctus** and the presence of leaves of plants. In the place of **Spirifer disjunctus** there are present two brachiopods that are often associated with it: **Douvillina** and **Leptostrophia.** The presence of **Atrypa hystrix** indicates the upper portion of the Chemung, and the presence of a number of **Palaeanatina** indicates that the beds are in the uppermost shales of the Chemung. This is further emphasized by the presence of **Productella lachrymosa.**

Valley Head Sandstone.

No. 28.—Location: Along Knapp Creek 4.5 miles southeast of Marlinton, at elevation of 2200 feet.

Matrix: A gray argillaceous shale with iron-stained surface.

Fossils: There are two specimens. The larger is a flattened stem 16 cm. long, with cross-section 8 cm. x 3 cm., flat on the lower side. The rounded surface is faintly and irregularly ribbed in a longitudinal direction, but there are no leaf impressions. On the surface and close beside are several concretionary spherical masses about 3 mm. in diameter. The small specimen contains outlines of two small twigs.

These forms resemble what Dr. David White has classed as **Protolepidodendron.** No microscopic structure is available.

No. 29.—Location: Along Knapp Creek 4.5 miles southeast of Marlinton, at elevation of 2200 feet.

Matrix: A fine-grained grayish shaly sandstone, somewhat micaceous, with some of the surface stained with limonite.

Fossils:

Impressions of plants
Spirifer disjunctus
Atrypa hystrix.

Comment: One specimen is that of a flattened stem 11.2 cm. long, 4 cm. wide, and 1 cm. thick, flat on one side, rounded on the other (**Protolepidodendron** ?). There are five impressions of parallel plant structure, three of which retain carbon and two of which retain markings of epidermal tissue. One specimen seems to be the rounded end of a parallel-veined leaf of which 2.5 cm. x 0.5 cm. are preserved.

Most of the impressions of the marine shells are in fragments, but there are two forms that are sufficiently complete for identification. One is **Spirifer disjunctus**, which is found throughout the Chemung. The other is **Atrypa hystrix**, which marks a horizon in the upper half of the Chemung.

No. 30.—Location: Laurel Creek, 0.2 mile west of Rimel at elevation of 2440 feet.

Matrix: A fine-grained shaly and somewhat micaceous sandstone.

Fossils: The four specimens contain impressions of plants. The largest specimen contains the outline of a stem 12.5 cm. long, with oval cross-section 3 cm. broad and apparently 1.8 cm. deep, the impression being flattened out in the plane of stratification. The cortex is removed and no markings are left either of structure or of leaf impressions. A second specimen contains an irregular flattened disk that in becoming flattened had developed numerous longitudinal cracks, but nothing definite is preserved. A third specimen has several plant impressions the most important of which is 9.0 cm. long, and is 0.7 cm. broad near one end. It bears evidence of longitudinal fluting the outside portions of which diverge into two lateral branches. The fourth specimen has an impression 6.5 cm. long and 2.5 cm. wide, of flattened woody grain preserved in dark-brownish iron stain. The largest specimen seems to correspond to **Protolepidodendron**.

No. 35.—Location: On Knapp Creek, 1 mile northwest of Huntersville, at elevation of 2240 feet.

Matrix: There are three phases of deposition in the matrix. The first is that of a bluish-gray, non-calcareous shale, somewhat siliceous, and with minute particles of mica. It is this material that contains the plant remains. The second phase is that of a dense dark limestone, very fossiliferous. The third phase is that of a brownish, fine-grained sandstone, very fossiliferous, but with the original calcareous material of the shells entirely removed by solution, leaving the impressions of the shells. The relation of this phase to the others is evident in two ways. In one specimen the brownish sandstone has upon one side a thin deposit of the bluish-gray slightly micaceous sandstone or shale. In another specimen the bluish limestone and the weathered brownish fine-grained siliceous material are irregularly mixed, making it evident that the brownish phase is that of the weathered limestone.

Fossils:

Plant remains
Crinoid stems
Bryozoa (branching)
Fenestella sp.
Leptostrophia perplana var. nervosa
Douvillina cayuta
Atrypa hystrix
Spirifer disjunctus
Loxonema sp.
Holopea sp.

Comment: From this assemblage it is clear that the horizon from which the specimens came is in the upper half of the Chemung.

No. 42.—Location: On Knapp Creek, 3.1 miles southeast of Marlinton, at elevation of 2200 feet.

Matrix: There are two different phases. One is a dark-brown fine-grained sandstone. The other is a grayish fine-grained slightly micaceous sandstone.

Fossils: The grayish sandstone contains the following:

Spirifer mesacostalis (abundant)
Palaeanatina angusta
Cypricardella gregaria
Palaeoneilo filosa.

The dark-brown sandstone contains the following:

Crinoid stems
Bryozoa (branching)
Leptostrophia perplana var. nervosa
Spirifer disjunctus
Grammysia undata
Palaeoneilo filosa.

Comment: **Spirifer mesacostalis** is reported abundant from the uppermost beds of the Portage to the Upper Conglomerate in the Chemung, but not abundant above that horizon. The assemblage, though meager, refers the sandstone to the upper middle beds of the Chemung. This position is further emphasized by the presence of the fossils in the dark-brown sandstone, which bed, it is understood, was found closely associated with the gray sandstone.

No. 50.—Location: No location is stated, except that the two specimens came from the Chemung of Pocahontas County.

Matrix: A fine-grained slightly micaceous, yellowish-gray sandstone, with upper and lower surfaces both of finer material of a dark brownish-red color, seen also along thin partings in the sandstone.

Fossils:

Crinoid stems, cirri, and pinnules.

Comment: Here is evidently a part of the arms and pinnules around the head of a large crinoid. The parts exposed are not the parts needed in classification.

No. 52.—Location: On State road (No. 43) along Knapp Creek, 4.5 miles east of Marlinton, at elevation of 2200 feet.

Matrix: The matrix is of two kinds. One is a grayish, fine-grained, shaly sandstone, somewhat micaceous, with partings that are fossiliferous and stained yellowish-brown. The other matrix is a gray limestone, very fossiliferous in some of the layers along which weathering has proceeded.

Fossils: The shaly sandstone contains the following:

Crinoid stems
Leptostrophia perplana var. nervosa
Douvillina cayuta

Schuchertella chemungensis
Camarotoechia eximia
Camarotoechia orbicularis ?
Camarotoechia sp.
Spirifer mesacostalis.

The gray limestone contains the following:

Crinoid stems
Leptostrophia perplana var. nervosa
Camarotoechia sp.

Comment: Such an assemblage indicates the central portion of the Chemung.

PORTAGE SERIES.

No. 1.—Location: 0.5 mile north of Huntersville, at elevation of 2235 feet.

Matrix: A dark-gray and brownish fine-grained, micaceous, non-calcareous shale.

Fossils: There are but three partial imprints of the central portions of ventral shells. One may be part of a distorted **Tropidoleptus carinatus.** Another favors **Atrypa reticularis.** The third is wholly indefinite.

Comment: The field question is, do the fossil fragments favor the Portage or the Genesee?

Both of the species mentioned are reported from the Hamilton and also from the Parkhead, uppermost division of the Portage. Neither one is reported from the Genesee, neither from the Naples division of the Portage, and only **Atrypa reticularis** from the Ithaca division of the Portage. The answer is, then, that the fragments favor the uppermost division of the Portage (Parkhead). The material is, however, too imperfect to be satisfactory.

No. 31.—Location: 0.6 mile north of Huntersville, at elevation of 2235 feet.

Matrix: A grayish, micaceous shale.

Fossils: Impressions of stems of algae.

No. 37.—Location: 0.2 mile south of road forks at Frost, at elevation of 2560 feet.

Matrix: A light-buff, non-calcareous, argillaceous shale, in places tinged with pink.

Fossils:

Buchiola retrostriata
Paracardium doris
Nucula corbuliformis
Pterochaenia fragilis
Lunulicardium cymbula
Cypricardella bellistriata
Gastropod
Bactrites aciculus
Probeloceras lutheri
Pharetrella tenebrosa ?

Comment: The specimen adjudged to be **Pharetrella** is incomplete, but the markings are more like **Pharetrella** than **Orthoceras**. All the forms are found both in the Portage and in the Genesee, but other forms characteristic of the Genesee are wanting, and all but two of these are rare in the Genesee. Further, the shale is not of the dark type found in the Genesee. The absence of index fossils of the Genesee and the presence of a typical Naples fauna, indicate that the horizon is in the Portage (Naples).

No. 41.—Location: 0.75 mile northwest of Frost, at elevation of 2600 feet.

Matrix: A light slate-colored, argillaceous shale, some of it slightly dark slate-colored, and some of it stained with limonite.

Fossils:

Productella lachrymosa
Buchiola retrostriata
Pterochaenia fragilis
Cypricardella bellistriata
Sandbergeroceras syngonum ?

Comment: This small collection of eight fragments contains three species of fossil shells that may be found in Genesee strata as well as in Portage strata (Naples fauna), but they do not contain evidence of forms that are distinctive of the Genesee, and the material, while not really light-colored shale, is more like Portage than it is like Genesee Shale. A fragment of special interest is that containing a portion of a goniatite which is thought to be **Sandbergeroceras**

syngonum. Because of the absence of index Genesee fossils and the presence of only those forms which range up into the Portage, and because of the light-colored character of the shale, it is judged to be Portage Shale (Naples fauna).

No. 43.—Location: 1 mile south of Minnehaha Springs, at elevation of 2350 feet.

Matrix: A dark, greenish-gray, non-calcareous, argillaceous shale, with reddish-brown stains of iron in cracks.

Fossils:

Buchiola retrostriata
Actinopteria sp.
Cypricardella bellistriata
Pterochaenia fragilis
Tentaculites sp.
Bactrites aciculus
Orthoceras sp.
Probeloceras lutheri
Sandbergeroceras syngonum ?

Comment: In the above list **Cypricardella bellistriata** is the only form reported from strata younger than the Portage (Naples fauna). **Sandbergeroceras syngonum** is not reported in any fauna prior to the Naples fauna. Unfortunately this latter named fossil is not sufficiently complete for exact identification, since only the marks of an external impression are present. These are the evenly curved ornamental lines of growth, evidently of a goniatitic type, a type which is more abundant in later deposits. Further, **Styliolina fissurella** is not present, a form which is both a characteristic and an index fossil of the Genesee. Thus, though all the other fossils are also reported from the Genesee (or below), the evidence centers in the Portage (Naples fauna).

GENESEE SERIES.

No. 11.—Location: At a sharp curve along the road 1.0 mile southwest of Browns Creek School, at elevation of 2275 feet.

Matrix: A dark, almost black, argillaceous shale, non-calcareous.

Fossils:

Paracardium doris (abundant)

Pterochaenia fragilis
Styliolina fissurella
Bactrites aciculus
Probeloceras lutheri.

Comment: In this list **Bactrites** alone has a long vertical range, the species **aciculus** occurring in the Genesee Shale. The other species are also reported from the Genesee Shale.

No. 14.—Location: On Knapp Creek, 0.2 mile southwest of Westminster Church, at elevation of 2375 feet.

Matrix: A dark, argillaceous shale, non-calcareous, somewhat stained by limonite.

Fossils:

Crinoid stem (fragment)
Buchiola livoniae ?
Pterochaenia fragilis
Styliolina fissurella
Bactrites aciculus
Probeloceras lutheri.

Comment: The shale is clearly a Genesee Shale.

No. 15.—Location: 0.8 mile south of Minnehaha Springs, at elevation of 2375 feet.

Matrix: A dark, argillaceous, non-calcareous shale, somewhat stained by limonite.

Fossils:

Plant (faint Lepidodendron-like impressions)
Buchiola retrostriata
Paracardium doris
Pterochaenia fragilis (abundant).

Comment: **Paracardium doris** is reported from the Genesee only. While the other species named are characteristic of the Genesee they are not confined to that formation.

No. 16.—Location: Along State road (No. 42), 0.4 mile southwest of Moore School, at elevation of 2450 feet.

Matrix: A dark, argillaceous shale, non-calcareous.

Fossils:

Buchiola retrostriata
Paracardium delicatulum ?
Pterochaenia fragilis
Bactrites aciculus
Tornoceras uniangulare.

Comment: The shale is clearly a Genesee Shale.

No. 63.—Location: On State road (No. 42), north side of Knapp Creek, at Mill Run, 2.0 miles southwest of Frost.

Matrix: A black, fissile, non-calcareous shale, some of it weathered dark-brown. Limonite occurs in the partings.

Fossils:

Fucoid impression ?
Lingula nuda
Schuchertella variabilis
Buchiola retrostriata
Styliolina fissurella
Pharetrella tenebrosa
Bactrites aciculus
Worm tubes ?

Comment: This assemblage of fossils indicates the Genesee Shale. **Schuchertella variabilis** is reported from the Marcellus and from the Hamilton, but not from the Genesee that lies above them.

HAMILTON SERIES.

No. 13.—Location: On Knapp Creek, 0.2 mile northeast of Westminster Church, at elevation of 2375 feet.

Matrix: A dark, argillaceous and finely arenaceous shale with minute flakes of mica. It weathers brown, and cleaves with an even surface.

Fossils:

Calceola tenuicinctus
Lingulella paliformis
Palaeoneilo ?
Conularia undulata.

Comment: The above fossils relate the shale to the Hamilton, and not to the Portage.

No. 27.—Location: Marine road ballast at Huntersville bridge.

Matrix: A dark, brownish-gray decomposing limestone.

Fossils:

Chonetes coronatus
Spirifer consobrinus
Ambocoelia virginiana.

Comment: The rock as a whole is a mass of **Ambocoelia virginiana**, a form that is found in both the Marcellus and the Hamilton. With these are a few **Chonetes coronatus** and **Spirifer consobrinus**, both of which are found in the Hamilton only.

MARCELLUS SERIES.

Onondaga.

No. 20.—Location: Just east of Cove Hill School, one mile northwest of Frost, at elevation of 2625 feet.

Matrix: A dark, argillaceous, non-calcareous shale, with considerable limonite in the partings.

Fossils:

Anoplotheca acutiplicata
Ambocoelia virginiana
Buchiola halli
Platyostoma sp.
Styliolina fissurella
Tentaculites sp.

Comment: **Anoplotheca acutiplicata** is distinctive of the Onondaga, or lowest division of the Marcellus. It is here represented by numerous compressed forms. **Ambocoelia virginiana**, **Buchiola halli**, and **Styliolina fissurella** are all reported from both the Marcellus and the Hamilton.

ORISKANY SERIES.

Huntersville Chert.

No. 53.—Location: Half a mile northwest of Burr Post-Office, at elevation of 2750 feet.

Matrix: The matrix is of two types. The first is light-colored, almost white, fine-grained sandstone, with outside weathered to a light-brown, and in places stained by iron oxide. The second is a light-gray chert consisting of angular fragments of chert cemented together by chert. It is in part stained by iron oxide.

Fossils: The sandstone contains the following:

Leptaena rhomboidalis var. ventricosa
Spirifer intermedius.

The chert contains the following:

Orbiculoidea ampla
Leptaena rhomboidalis var. ventricosa
Schuchertella woolworthana
Diaphorostoma ventricosum
Diaphorostoma depressum.

Comment: These are all fossils of the Oriskany. Parts of both valves of **Orbiculoidea ampla** are nicely preserved in the chert.

No. 64.—Location: Top of quarry, Knapp Creek, 1.5 miles southwest of Frost.

Matrix: A brittle, greenish, shaly, non-calcareous sandstone, breaking irregularly, stained brownish somewhat from oxidation of abundant ferrous iron.

Fossils:

Orbiculoidea ampla.

HELDERBERG SERIES.

Keyser.

No. 2.—Location: Along State road (No. 43), 0.4 mile southwest of Huntersville, at elevation of 2260 feet.

Matrix: A dark, grayish-brown, fine-grained, arenaceous limestone or calcareous sandstone containing ostracods, indefinite black flakes and angular fragments of brachiopods. Weathering has in places brought to light a distinct lamination.

Fossils:

Gastropod (small, flat-coiled)
Leperditia sp.
Kloedenia pennsylvanica ?

Comment: The horizon is an ostracod horizon. The presence of **Kloedenia** refers it to the Helderberg. If the species is **pennsylvanica**, as it appears to be, the horizon is in the

Keyser. One form corresponds to **Leperditia.** Another of elongated shape that approaches **L. elongata,** lacks an oblique backward turn from the hinge line, and thus while presenting a broad semicircular anterior curve also presents a smaller similar curve at the posterior end. Two indistinct coiled outlines are apparently due to small flat-coiled gastropods, and there is a fragment of a small brachiopod shell. Aside from these the fragments are too unsatisfactory for recognition.

No. 54.—Location: "Glade Hill", along Thorny Branch, 1.5 miles northeast of Hillside School, at elevation of 2600 feet.

Matrix: The matrix is judged to have been originally white sand (silica) and lime. At present the sand is cemented by silica. The lime of the fossils is entirely gone, and many cavities of fragments of shells are left now lined with silica. The matrix thus suggests Oriskany Sandstone, and leads to a field question as to whether the horizon is that of the Oriskany or of the Helderberg.

Fossils:

Favosites helderbergiae var. praecedens
Fenestella sp.
Brachiopoda (indefinite fragments)
Kloedenella.

Comment: The field question is definitely answered by the character of the coral, and almost as definitely answered by the presence of **Kloedenella.** The horizon is that of the Helderberg Limestone.

SILURIAN.

SALINA SERIES.

Bossardville.

No. 4A.—Location: Along the State road (No. 43), 0.7 mile southeast of Huntersville, at elevation of 2255 feet.

Matrix: A dark-gray limestone, very fossiliferous.

Fossils:

Camarotoechia tonolowayensis (abundant)
Camarotoechia litchfieldensis.

Comment: The two forms named are both characteristic of the Bossardville Limestone, with which also the character of the matrix agrees.

No. 49.—Location: About 2 miles east of Dunmore and one mile northeast of Hillside School, at elevation of 2600 feet.

Matrix: A light-gray, thin-bedded limestone, very fossiliferous—a bed of bryozoa.

Fossils:

Crinoid stems
Fenestella
Bryozoa (encrusting)
Bryozoa (branching)
Leptaena rhomboidalis
Indefinite fragments of brachiopods.

Comment: The field question is this: Is the horizon that of the Bossardville or that of the Helderberg? As the forms that are found may belong to either of these horizons the answer to that extent is indefinite. The absence of **Kloedenia** and **Kloedenella** favors the Bossardville.

No. 51.—Location: 1.0 mile northwest of Frost, at elevation of 2725 feet.

Matrix: A black limestone in thin layers.

Fossils: The very small specimen contains two corals:

Favosites niagarensis
Favosites sp.

Comment: **Favosites niagarensis** is reported from the Bossardville and also from the McKenzie. The matrix corresponds to that of the Bossardville.

NIAGARA SERIES.

McKenzie.

No. 12.—Location: On branch of Browns Creek, along the stream bed, 1.0 mile southwest of Mt. Tabor School, at elevation of 2500 feet.

Matrix: A dense, dark limestone, very fossiliferous, weathering to a brownish-drab limestone.

Fossils:

Favosites marylandicus
Obiculoidea clarki
Leptaena rhomboidalis
Whitfieldella marylandica
Hormotoma marylandica
Leperditia alta
Eukloedenella simplex
Kloedenella subovata.

Comment: All of these forms are found in the McKenzie Limestone. From their relative abundance they mark a horizon at the center or a little below the center of the formation.

No. 25.—Location: 1.2 miles southeast of Dilleys Mill and 0.3 mile northeast of Bethel School, at elevation of 2775 feet.

Matrix: The three hand specimens of this collection consist of weathered dark limestone that contains many shell spaces now filled with white calcite. The limestone itself contains many glistening surfaces of calcite, and the weathered surface reveals many minute fragments of shells.

Fossils:

Favosites niagarensis
Schuchertella sp.
Hormotoma hopkinsi
Orthoceras mckenzicum
Leperditia sp.
Kloedenella sp.

Comment: The above identifications place the limestone in the McKenzie, but the material is too meager and imperfect to be satisfactory.

CLINTON SERIES.

Rochester Shale (of Maryland).

No. 3.—Location: Along State road (No. 43), 0.6 mile southeast of Huntersville, at elevation of 2255 feet.

Matrix: A soft, yellowish-brown, argillaceous shale. non-calcareous.

Fossils:

Camarotoechia neglecta
Meristina sp.

Comment: The fossils are found in the Rochester Shale, but they are not distinctive of it.

WHITE MEDINA SERIES.

No. 4.—Location: 0.7 mile southeast of Huntersville, at elevation of 2255 feet.

Matrix: A compact gray shale is clinging to one of the fragments. The field label states that the pieces are "from a dark, sandy shale between White Medina ledges".

Fossils:

Fucoid fragments.

Comment: The material consists of numerous fragments of the same or similar individuals of a branching form. The fragments are somewhat flattened and of various diameters from 2 mm. up to 6 mm. The surface is smooth, without marking. Polished cross-sections reveal scattered yellowish blotches (limonite) amid minute grains of quartz sand. As a longitudinal polished section reveals similar blotches it is evident the material does not at all preserve ducts. Neither does it present the structure of corals or of bryozoa. The pieces are not of uniform width and do not have transverse ridges as in **Arthrophycus,** neither are they of the slender flexible type, with uniform width, as in **Buthotrephis gracilis.** They are judged to be fragments of stems of plants (fucoids) replaced by a fine quartz sand, without preservation of structure.

No. 61.—Location: East side of Beaver Lick Mountain, along Cummins Creek.

Matrix: Dense white quartz sand, essentially a quartzite, slightly iron-stained along cracks.

Fossils: The weathered surface of the larger specimen is a mass of **Arthrophycus harlani.** The weathered surface of the smaller specimen reveals an irregular banded appearance, without evident organic structure. Whether this is due to crumpling of thin layers or is due to original organic structure is not evident, for a polished surface reveals no more than the weathered surface.

RED MEDINA SERIES.

No. 34.—Location: 0.8 mile southeast of Huntersville, at elevation of 2260 feet, and 200 to 250 feet below the top of the formation.

Matrix: A fine-grained, reddish, micaceous sandstone, containing irregular greenish patches, some of which seem to be due to infiltration along bedding-planes.

Fossils: The Red Medina (Juniata) Sandstone has been considered non-fossiliferous, but among these specimens are rounded, curved, and branching forms that are judged to be evidence of algae.

APPENDIX.

LEVELS ABOVE MEAN TIDE AND GAZETTEER.

RAILROAD LEVELS.

CHESAPEAKE AND OHIO RAILWAY*.

Greenbrier Branch.

Miles from Ronceverte.	Stations.	State.	County.	Elevation Feet.
0.0	Ronceverte	W. Va.	Greenbrier	1670
2.8	Whitcomb	W. Va.	Greenbrier	1705
4.6	North Caldwell	W. Va.	Greenbrier	1696
13.8	Keister	W. Va.	Greenbrier	1774
16.9	Anthony	W. Va.	Greenbrier	1800
24.4	Spring Creek	W. Va.	Greenbrier	1862
27.6	Renick	W. Va.	Greenbrier	1877
34.8	Droop Mountain	W. Va.	Pocahontas	1943
41.3	Beard	W. Va.	Pocahontas	2015
48.6	Seebert	W. Va.	Pocahontas	2064
50.9	Watoga	W. Va.	Pocahontas	....
55.0	Buckeye	W. Va.	Pocahontas	2112
58.9	Marlinton	W. Va.	Pocahontas	2131
65.1	Clawson	W. Va.	Pocahontas	....
73.9	Clover Lick	W. Va.	Pocahontas	2295
79.7	Sitlington	W. Va.	Pocahontas	2370
83.5	Cass	W. Va.	Pocahontas	2455
90.9	Hosterman	W. Va.	Pocahontas	2592
94.8	Boyer	W. Va.	Pocahontas	....
98.4	Durbin	W. Va.	Pocahontas	2724
100.9	Bartow	W. Va.	Pocahontas	2776
103.7	Winterburn	W. Va.	Pocahontas	2868

*Bulletin 2, W. Va. Geol. Sur., p. 54; 1911.

WESTERN MARYLAND RAILWAY.*

Durbin Branch.

Miles from Baltimore.	Stations.	State.	County.	Elevation Feet.
274.7	Elkins	W. Va.	Randolph	1933
279.4	Tunnel Station	W. Va.	Randolph	2326
....	Tunnel No. 1 Summit	W. Va.	Randolph	2367
280.8	Lumber	W. Va.	Randolph	2298
282.3	Meadows	W. Va.	Randolph	2181
284.2	Faulkner	W. Va.	Randolph	2206
284.8	Bowden	W. Va.	Randolph	2212
289.2	Woodrow	W. Va.	Randolph	2353
290.5	Montes	W. Va.	Randolph	2426
293.5	Bemis	W. Va.	Randolph	2591
296.8	Morribell	W. Va.	Randolph	2838
....	Tunnel No. 2 Summit	W. Va.	Randolph	2939
299.2	Glady	W. Va.	Randolph	2915
....	Summit Cut	W. Va.	Pocahontas	3147
305.8	Wildell	W. Va.	Pocahontas	3060
....	Gertrude	W. Va.	Pocahontas	3006
310.6	May	W. Va.	Pocahontas	2963
313.9	Burner	W. Va.	Pocahontas	2923
316.1	Braucher	W. Va.	Pocahontas	2882
321.8	Durbin	W. Va.	Pocahontas	2723

*Bulletin 2, W. Va. Geol. Sur., p. 40; 1911.

UNITED STATES GEOLOGICAL SURVEY LEVELS.

The various topographic quadrangles (Cass, Durbin, Hightown, Lobelia, Marlinton, Mingo, Spruce Knob, Warm Springs, and Webster Springs) which make up the area of Pocahontas County have been covered with a network of primary spirit-levels run by the United States Geological Survey.

The following descriptive remarks are quoted from Bulletin No. 632 of the United States Geological Survey, pages 5-7; 1916:

"**Classification.**—The elevations are classified as precise or primary, according to the methods employed in their determination. The former are determined by lines of levels run either in both forward and backward directions or by simultaneous double-rodded lines, a high-grade instrument being used and special precautions being taken in observations and reduction to correct errors and make the line continuously good throughout. The latter or primary levels are determined with the Y level, precautions being taken against only the principal errors and the levels being run mostly in circuits of single lines. The allowable limit of error observed on the precise work already done by the Geological Survey in this State is represented in feet by 0.02 times the square root of D, and that for the primary work by 0.05 times the square root of D in which D is the length of the circuit in miles.

"**Bench Marks.**—The standard bench marks are of two forms. The first form is a circular bronze or aluminum tablet, 3½ inches in diameter and ¼ inch thick, having a 3-inch stem, which is cemented in a drill hole in solid rock in the wall of some public building, a bridge abutment, or other substantial masonry structure. The second form, used where masonry or rock is not available, consists of a hollow wrought-iron post 3½ inches in outer diameter and 4 feet in length. The bottom is spread out to a width of 10 inches in order to give a firm bearing on the earth. A bronze or aluminum cap is riveted upon the top of the post which is set about 3 feet in the ground. A third style of bench mark, with abbreviated lettering, is used for unimportant points. This consists of a special copper nail 1½ inches in length driven through a copper washer ⅞ inch in diameter. The tablets as well as the caps on the iron posts are appropriately lettered, and co-operation by States is indicated by the addition of the State name.

"The numbers stamped on the bench marks described in the following pages represent the elevations to the nearest foot as determined by the levelman. These numbers are stamped with $\frac{3}{16}$-inch steel dies on the tablets or post caps, to the left of the word 'Feet'. The office adjustment of the notes and the reduction to mean sea-level datum may so change some of the figures that the original markings are 1 to 2 feet in error. It is assumed that engineers and others who have occasion to use the bench-mark elevations will apply to the Director of the United States Geological Survey, at Washington, D. C., for the adjusted values, and will use the markings as identification numbers only.

"**Datum.**—All elevations determined by the United States Geological Survey and United States Coast and Geodetic Survey are referred to mean sea-level, which is the level that the sea would assume if the influence of winds and tides were eliminated. This level is not the elevation determined from the mean of the highest and the lowest tides, nor is it the half sum of the mean of all the high tides and the mean of all the low tides, which is called the half-tide level. **Mean sea-level is the average height of the water, all stages of the tide being considered.** It is determined from observations made by means of tidal gages placed at stations where local conditions, such as long narrow bays, rivers, and like features, will not affect the height of the water. To obtain even approximately correct results these observations must extend over at least one lunar month, and if accuracy is desired they must extend over several years. At ocean stations the half-tide level and the mean sea-level usually differ but little. It is assumed that there is no difference between the mean sea-levels determined from observations in the Atlantic Ocean, the Gulf of Mexico, and the Pacific Ocean.

"The connection with tidal stations for bench marks in certain areas that lie at some distance from the seacoast is still uncertain, and this fact is indicated by the addition of a letter or word to the right of the word 'Datum' on tablets and posts. For such areas corrections for published results will be made from time to time as the precise-level lines of the United States Geological Survey, the United States Coast and Geodetic Survey, or other Government organizations are extended."

The primary levels by the United States Geological Survey, run in cooperation with the West Virginia Geological Survey, taken in part from Bulletin No. 632 of the United States Geological Survey, but mainly from unpublished data supplied by the Director of the latter Survey, are given below. The levels are given by topographic quadrangles and cover the area of Pocahontas included in the various sheets as also a portion of the adjoining counties shown thereon. Mileages mentioned in the descriptions of bench marks are road mileages and are not air-line distances from the towns and post-offices mentioned to the points where the levels were taken:

CASS QUADRANGLE: POCAHONTAS COUNTY.

(Latitude 38° 15′-38° 30′; Longitude 79° 45′-80° 00′).

Primary leveling by E. E. Harris in 1921:

From Durbin Quadrangle southwest along Chesapeake and Ohio Railroad, across quadrangle into Mingo Quadrangle near its southeast corner.

	Feet.
Boyer Station (Nottingham P. O.), 1.31 miles southwest of, 10 feet east of track, on top of 15-inch drain pipe; chiseled square, rock marked "U. S. B. M. 2,635.5"..	2,635.68
Boyer Station (Nottingham P. O.), 2.07 miles southwest of, 1.99 miles northeast of Hosterman, 50 feet south of mile-post W 90, 20 feet west of track, in top of boulder; bronze tablet stamped "W. Va. 1921 H 149 2622", fence marked "U. S. B. M. 2,622"........	2,622.255
Reference mark, 18 feet south 15° west of tablet, on top of boulder; chiseled square.........................	2,622.40
Hosterman, 0.98 mile northwest of, 40 feet north of mile-post W 89, 10 feet west of track, on top face of ledge of rock; chiseled square, rock marked "U. S. B. M. 2,605.8"...................................	2,606.01
Hosterman, 290 feet north of station, in west end of south bridge seat of railroad trestle No. 881; chiseled square, bridge rail marked "U. S. B. M. 2,582.1"...	2,582.33
Hosterman, in front of station-sign, end of tie marked "U. S. 2,584.3", top of near rail.......................	2,584.50
Hosterman, 0.91 mile southwest of, 900 feet north of mile-post W 87, 0.32 mile north of Nida, 10 feet west of track, top of pointed boulder; chiseled square, boulder marked "U. S. B. M. 2,570.3"..............	2,570.55

	Feet.
Nida, in front of station-sign, end of tie marked "U. S. B. M. 2,564.5"; top of near rail..........................	2,564.7
Nida, 0.47 mile southwest of, 50 feet south of railroad trestle No. 864 over Trout Run, 15 feet west of track, in top of large sandstone boulder; bronze tablet stamped "2557 W. Va. 1921 H 150", boulder marked "U. S. B. M. 2,557"..................................	2,557.177
Reference mark, 44.6 feet north of tablet, in east end of south bridge seat of railroad trestle No. 864 over Trout Run; chiseled square.......................	2,555.10
Nida, 1.57 miles southwest of, 1,800 feet north of mile-post W 85, 10 feet west of track, on south end of large boulder; chiseled square, boulder marked "U. S. B. M. 2,529.1"......................................	2,529.32
Nida, 2.37 miles southwest of, 0.22 mile northeast of **Wanless Station,** 550 feet north of farm road crossing, 10 feet north of track, on top of boulder; chiseled square, boulder marked "U. S. B. M. 2,510.8"......	2,510.96
Wanless Station, in front of station-sign, end of tie marked "U. S. 2,508.4", top of near rail....................	2,508.6
Wanless Station, 1.07 miles southwest of, 2.70 miles northeast of **Cass,** 10 feet north of track, at east end of tangent, in top of sandstone boulder; bronze tablet stamped "W. Va. 1921 H 151", telegraph-pole marked "U. S. B. M. 2,485.1" (not found in 1924)...........	2,485.316
Reference mark, 29.2 feet west of tablet, on top of boulder; chiseled square.................................	2,488.00
Cass, 1.81 miles northeast of, 1,870 feet north of mile-post W 82, at north end of west bridge seat of railroad trestle No. 825; chiseled square, guard-rail of bridge, marked "U. S. B. M. 2,467.4".......................	2,467.59
Cass, 0.70 mile northeast of, 70 feet south of target-switch, 20 feet east of track, on top of boulder; chiseled square, boulder marked "U. S. B. M. 2,453.1"......	2,453.24
Cass, in front of station, east face of station platform; marked "U. S. 2,441.23"; top of rail of main-line track	2,441.5
Cass, west of station, in northeast corner of large concrete foundation, in front of post-office and store of the Pocahontas Supply Company; bronze tablet stamped "2452 W. Va. 1921 H 152".........................	2,452.164
Reference mark, 45.6 feet south 25° west of tablet, in south end of lower stone step at entrance to Pocahontas Supply Company; chiseled square.................	2,452.68

	Feet.
Cass, 0.98 mile southwest of, 600 feet northeast of **Deer Creek**, 40 feet west of track, northeast of right-angle turn in dirt road, in east root of large stump; copper nail and washer, telegraph-pole marked "U. S. B. M. 2,415.9"	2,416.14
Deer Creek, in front of station-sign; top of near rail, end of tie marked "2,417"	2,417.2
Deer Creek, 0.87 mile south of, 0.30 mile northeast of **Raywood**, 10 feet west of track, on top face of long ledge of rock; chiseled square, rock marked "U. S. B. M. 2,399.3"	2.399.49
Raywood, in front of station, end of tie marked "U. S. 2,392.1"; top of rail	2,392.3
Raywood, 0.65 mile southwest of, 0.95 mile northwest of **Sitlington**, 10 feet west of track, on top of 18-inch drain pipe; chiseled square, telegraph-pole marked "U. S. B. M. 2,379.6"	2,379.83
Sitlington, in front of station, end of tie marked "U. S. 2,363.4"; top of rail	2,363.6
Sitlington, 25 feet south of track, in concrete wall around station, east side of; bronze tablet stamped "W. Va. 1921 H 153 2363", boulder marked "U. S. B. M. 2,363.3"	2,363.477
Reference mark, 101.5 feet north 65° east of tablet, in right-angle turn in concrete wall to station platform; chiseled square	2,363.85
Sitlington, 0.97 mile northwest of, 800 feet south of mile-post W 75, 10 feet north of track, on top face of ledge of rock; chiseled square, rock marked "U. S. B. M. 2,344"	2,344.22
Sitlington, 1.79 miles west of, 0.65 mile southeast of **Stony Bottom**, 90 feet north of mile-post W 75, 10 feet west of track, on top face of ledge of rock; chiseled square, rock marked "U. S. B. M. 2,334.4"	2,334.56
Stony Bottom, in front of station-sign, end of tie marked "U. S. 2,328.8"; top of rail	2,329.0
Stony Bottom, 430 feet southwest of station, 30 feet west of track, on north bank of Elklick Run, set in top of large boulder; bronze tablet stamped "2329 W. Va. 1921 H 154", telegraph-pole marked "U. S. B. M. 2,328.7"	2,328.922
Reference mark, 40.5 feet south 25° east of tablet, in east end of north bridge seat of railroad trestle over run; chiseled square	2,326.92
Stony Bottom, 0.94 mile southeast of, 2,350 feet north of	

Feet.

mile-post W 73, 10 feet west of track, 30 feet south of farm road crossing track, to river, on top of outcrop of rock; chiseled square, rock marked "U. S. B. M. 2,316.6"..................................... 2,316.84

Stony Bottom, 2.02 miles southeast of, 1,930 feet north of mile-post W 72, 30 feet north of track, 20 feet east of fence line, on top of large boulder; chiseled square, boulder marked "U. S. B. M. 2,296.9"....... 2,297.11

Stony Bottom, 2.61 miles south of, 0.60 mile north of **Clover Lick**, 10 feet west of track, on rock ledge; chiseled square, rock marked "U. S. B. M. 2,295"............ 2,295.23

Clover Lick, in front of station, end of tie marked "U. S. 2,291.6"; top of near rail........................ 2,291.8

Clover Lick, 630 feet south of, 10 feet west of track, 220 feet north of mile-post W 71, on top face of ledge of rock; bronze tablet stamped "2289 W. Va. 1921 H 155", rock marked "U. S. B. M. 2,289".............. 2,289.238

Reference mark, 75.7 feet north 20° west of tablet, on ledge of rock; chiseled square.......................... 2,289.81

Clover Lick, 1.10 miles southeast of, 460 feet north of mile-post W 70, 10 feet west of track, on top of 12-inch drain pipe; chiseled square, telegraph-pole marked "U. S. B. M. 2,278.1"............................ 2,278.36

Clover Lick, 2.20 miles southwest of, 60 feet south of mile-post W 69, 10 feet west of track, on top face of ledge of rock; chiseled square, rock marked "U. S. B. M. 2,271.4"................................... 2,271.69

Clover Lick, 3.20 miles southwest of, 1.27 miles northwest of **Big Run**, 70 feet north of mile-post W 68, 10 feet west of track, in top face of ledge of rock; bronze tablet stamped "W. Va. 2,259 B. M."............... 2,259.238

Reference mark, 38.8 feet south 15° west of tablet, on top face of ledge of rock; chiseled square............. 2,259.48

Big Run, 0.14 mile northeast of, 15 feet north of mile-post W 67, 200 feet south of railroad trestle No. 670, 10 feet east of track, on top of boulder; chiseled square, boulder marked "U. S. B. M. 2,248.3"....... 2,248.58

Big Run, 0.76 mile southwest of, 20 feet south of mile-post W 66, east side of track, in top of rack for extra rail; copper nail and washer, telegraph-pole marked "U. S. B. M. 2,237.4"............................ 2,237.64

From Durbin Quadrangle south along W. Va. Pulp & Paper Co. Railroad to Cass.

Spruce Post-Office, 350 feet south of, 40 feet east of track, in top of large flat boulder; bronze tablet stamped

	Feet.
"3853 W. Va. 1921 H 144", boulder marked "U. S. B. M. 3,852.5"	3,852.578
Reference mark, 30.6 feet north of tablet, on top of pointed boulder; chiseled square	3,853.19
Spruce Post-Office, 0.97 mile south of, 10 feet east of track, on top of ledge of rock; chiseled square, rock marked "U. S. B. M. 3,920"	3,920.01
Spruce Post-Office, 1.25 miles south of, in gap of mountain, top of east rail at switch, marked "3,937.7"	3,937.67
Spruce Post-Office, 1.55 miles southeast of, 450 feet south of mile-post C 7, west side of track, on top of boulder; chiseled square, boulder marked "U. S. B. M. 3,867.8"	3,867.81
Spruce Post-Office, 2.53 miles south of, 5.43 miles northwest of **Cass,** 350 feet south of mile-post C 6, 10 feet west of track, in top of large boulder; bronze tablet stamped "3609 W. Va. 1921 H 145", boulder marked "U. S. B. M. 3,608.8"	3,609.063
Reference mark, 71.3 feet south 10° east of tablet, on top of boulder; chiseled square	3,604.87
Cass, 4.52 miles northwest of, 30 feet north of mile-post C 5, 10 feet west of track, boulder marked "U. S. B. M. 3,379.9"	3,380.33
Cass, 3.52 miles northwest of, 10 feet east of mile-post C 4, near east end of switchback, 10 feet south of track on top face of ledge of rock; chiseled square, rock marked "U. S. B. M. 3,158.9"	3,159.55
Cass, 2.88 miles northwest of, 40 feet east of mile-post C 3, 50 feet south of track, just west of leaning locust tree, in top of large sandstone boulder; bronze tablet stamped "2977 W. Va. 1921 H 146", boulder marked "U. S. B. M. 2,976.8"	2,977.594
Reference mark, 59.6 feet north 40° east of tablet, on top of boulder; chiseled square	2,977.81
Cass, 1.76 miles northwest of, at crossing of railroad and dirt road, 10 feet east by 10 feet north of, on top of large boulder; chiseled square, telephone-pole, marked "U. S. B. M. 2,698.3"	2,699.31
Cass, 0.99 mile northwest of, at crossing of railroad and county road, 50 feet north by 10 feet east of, in southeast corner of bridge over Leatherbark Run; copper nail and washer, bridge rail marked "U. S. B. M. 2,524.4"	2,525.63

From Hightown Quadrangle southwest along highways through southeast part of quadrangle into Warm Springs Quadrangle.

Feet.

Top of Allegheny, 2.92 miles southwest of, on east side of road, 100 feet south of spring, in angle of road, in east root of 10-inch oak tree; copper nail and washer, tree marked "U. S. B. M. 3,832.6".......... 3,832.51

Top of Allegheny, 3.68 miles southwest of, 1.52 miles northeast of **Oak Hill School**, at sharp turn in road, 35 feet west of and 15 feet north of lane, set in top of concrete post; bronze tablet stamped "3498 W. Va. 1921 H 131", gate-post marked "U. S. B. M. 3,497.9" 3,497.857

Reference mark, 49.8 feet south 20° east of tablet, in south root of 12-inch chestnut oak tree; copper nail and washer 3,502.68

Oak Hill School, 0.77 mile east of, on east edge of road, 10 feet east of fence line, 200 feet north of right-angle turn in road, across road from house, in west root of 24-inch chestnut tree; copper nail and washer, gate-post marked "U. S. B. M. 3,245.83"............ 3,245.83

Oak Hill School, across road from, 80 feet north of, in east root of large stump; copper nail and washer, tree marked "U. S. B. M. 3,009.9"..................... 3,009.99

Oak Hill School, 0.84 mile west of, in southeast corner of ┬-road east, 30 feet south by 20 feet east of, set in top of concrete post; bronze tablet stamped "2723 W. Va. 1921 H 132", telephone-pole marked "U. S. B. M. 2,722.7" 2,722.881

Reference mark, 31.9 feet south 80° west of tablet, in top of stump; copper nail and washer.................. 2,721.83

Oak Hill School, 1.46 miles southwest of, at crossing of log railroad and county road, at forks of road, on east edge of, in west root of 15-inch poplar tree; copper nail and washer, tree marked "U. S. B. M. 2,734".. 2,734.26

Oak Hill School, 2.22 miles southwest of, at forks of road, 40 feet south of, 280 feet west of J. B. Orndorff's mill, in west root of an apple tree; copper nail and washer, fence marked "U. S. B. M. 2,764".......... 2,764.26

Oak Hill School, 3.40 miles southwest of, at forks of ┬-road west to **Green Bank**, 35 feet north by 35 feet west of, set in top of concrete post; bronze tablet stamped "2716 W. Va. 1921 H 161", fence-post marked "U. S. B. M. 2,715.4"..................... 2,715.716

Reference mark, 74.6 feet south 20° east of tablet, in north root of 15-inch pine tree; copper nail and washer.. 2,717.80

Oak Hill School, 4.32 miles southwest of, 50 feet west of north-and-south road, 40 feet south of ┬-road west, 0.2 mile east of **Oak Grove School**, in north root of

	Feet.
22-inch maple tree; copper nail and washer, fence-post marked "U. S. B. M. 2,702"	2,702.27
Oak Hill School, 5.11 miles southwest of, 1.29 miles north of **Wesley Chapel**, on east edge of road, 150 feet south of run crossing road, across road from house, in west root of 12-inch pine tree; copper nail and washer, tree marked "U. S. B. M. 2,744.4"	2,744.34
Wesley Chapel, 0.52 mile north of, on east edge of road, 50 north of small wooden bridge over Thorny Branch, in north root of large oak stump; copper nail and washer, gate-post marked "U. S. B. M. 2,744.6"	2,744.41
Wesley Chapel, in northeast corner of road forks, in west end of lower stone step, at entrance to church; bronze tablet stamped "2762 W. Va. 1921 H 162", fence-post marked "U. S. B. M. 2,762.3"	2,762.623
Reference mark, 72.6 feet south 20° west of tablet, on top of small boulder; chiseled square	2,758.24
Wesley Chapel, 1 mile southwest of, 40 feet west of road center, in field, 80 feet south of mail-box, in east root of 18-inch tree; copper nail and washer, tree marked "U. S. B. M. 2,692.7"	2,693.04
Wesley Chapel, 1.85 miles southwest of, 1.1 miles northeast of **Pine Hill School***, on east edge of road, 50 feet south of road forks, in north root of 6-inch pine tree; copper nail and washer, tree marked "U. S. B. M. 2,689.4"	2,689.76
Pine Hill School*, 100 feet south of, 50 feet east of road, just north of right-angle turn in road to west, in west root of 18-inch pine tree; copper nail and washer, tree marked "U. S. B. M. 2,528.4"	2,528.62
Pine Hill School*, 0.84 mile northwest of, 1 mile southeast of **Dunmore**, 6.80 miles north of **Frost**, in center of large grass triangle formed by forks of road, set in top of concrete post; bronze tablet stamped "W. Va. 1921 H 163", sign-post marked "U. S. B. M. 2,509" (in 1924, B. M. covered by hard-surfaced new road)	2,509.340
Reference mark, 26.1 feet south 20° west of tablet, in north root of 15-inch oak tree; copper nail and washer	2,512.66
Frost, 5.70 miles north of, on west edge of road, 540 feet north of forks of lane east, on top of large flat boulder; chiseled square, boulder marked "U. S. B. M. 2,526"	2,526.31

*Pine Hill School, now abandoned, was located at mouth of Shock Run, and has now been moved 0.5 mile north and renamed Hillside School.

	Feet.
Frost, 4.78 miles north of, on north edge of road, 140 feet west of **Mt. Hope Church**, in east root of 12-inch oak tree; copper nail and washer, tree marked "U. S. B. M. 2,629.1"	2,629.46
Frost, 4.02 miles north of, 0.76 mile south of **Mt. Hope Church**, on east edge of road, 80 feet south of right-angle turn in road to west, in top of large sandstone boulder; bronze tablet stamped "2655 W. Va. 1921 H 164", telephone-pole marked "U. S. B. M. 2,654.6"	2,654.965
Reference mark, 82.6 feet north 5° east of tablet, in east root of 30-inch oak tree; copper nail and washer	2,656.18
Frost, 2.88 miles north of, on east edge of road, in east root of 38-inch oak tree; copper nail and washer, tree marked "U. S. B. M. 2,700.3"	2,700.69
Frost, 1.95 miles north of, at crossing of county road and log railroad, 15 feet east by 30 feet north of, in west root of large stump; copper nail and washer, stump marked "U. S. B. M. 2,657.4"	2,657.71
Frost, 1.11 miles north of, on east edge of road, 70 feet north of Sugarcamp Run, in west root of 40-inch sugar tree; copper nail and washer, tree marked "U. S. B. M. 2,598.9"	2,599.19
Frost, 0.50 mile north of, at forks of road west, 30 feet north by 30 feet west of, set in top of large boulder set in place; bronze tablet stamped "W. Va. 1921 H 165", fence marked "U. S. B. M. 2,566.8" (in 1924, B. M. covered by new road)	2,567.103
Reference mark, 246 feet south 40° west of tablet, in north root of 24-inch oak tree; copper nail and washer	2,574.24
Frost, 350 feet east of post-office, on north edge of road, in west root of 15-inch maple tree; copper nail and washer, telephone-pole marked "U. S. B. M. 2,588.3"	2,588.665
Frost, 0.76 mile southwest of, at big turn in road, 60 feet north of and on east edge of lane north, in south root of 24-inch oak tree; copper nail and washer, tree marked "U. S. B. M. 2,541.2"	2,541.65
Frost, 1.57 miles southwest of, at concrete bridge over Knapp Creek, at base of west parapet wall to; chiseled square, wall of bridge marked "U. S. B. M. 2,498.6"	2,499.04
Frost, 2.34 miles southwest of, 40 feet east of road center, in southwest corner of yard to residence, set in top of large boulder, in place; bronze tablet stamped "W. Va. 1921 H 166", post marked "U. S. B. M. 2,496.7" (in 1924, B. M. covered by new road)	2,497.087

	Feet.
Reference mark, 95 feet north 40° east of tablet, in south root of 22-inch oak tree; copper nail and washer...	2,493.26

From Frost east along highways to Virginia-West Virginia line. (Double spur line).

Frost, 350 feet east of post-office, on north side of road, in west root of 15-inch maple tree; copper nail and washer..	2,588.71
Frost Post-Office, 1.10 miles east of, on south bank of road, on east side of small run, in north root of 15-inch pine tree; copper nail and washer, tree marked "U. S. B. M. 2,671"................................	2,671.38
Frost Post-Office, 2.08 miles northeast of, 30 feet south of road center, 20 feet east of an old log road south, in east root of a large oak tree; copper nail and washer, stump marked "U. S. B. M. 2,726.5"......	2,726.89
Frost Post-Office, 2.96 miles northeast of, on north edge of road, 550 feet east of large barn, just east of orchard, in top of sandstone boulder; bronze tablet stamped "W. Va. 1921 H 166", fence marked "U. S. B. M. 2,798.8" (B. M. destroyed in 1924; tablet found in top of fence-post)............................	2,799.172
Reference mark, 86.5 feet east of tablet, on top of large flat boulder; chiseled square.........................	2,800.79
Frost Post-Office, 3.91 miles northeast of, 900 feet east of shanty, 50 feet north of road center, in south root of 24-inch oak tree; copper nail and washer, tree marked "U. S. B. M. 2,912.7"......................	2,913.08
Frost Post-Office, 4.90 miles northeast of, on east edge of road, 100 feet north of gap and West Virginia-Virginia State line, in west root of 24-inch oak tree; copper nail and washer, tree marked "U. S. B. M. 3,157.7"	3,158.08

Near Boyer Station (on Durbin Quadrangle).

Boyer Station, in front of; top of rail, end of tie marked "U. S. 2,661.5".....................................	2,661.7
Boyer Station, 0.58 mile southwest of, 10 feet east of track, on top of 15-inch drain pipe; chiseled square, rock marked "U. S. B. M. 2,653.2".......................	2,653.43

From Mingo Quadrangle southeast to Clover Lick.

Primary leveling by P. E. Davenport in 1922:

Clover Lick, 2.24 miles northwest of, 250 feet east of Cloverlick Creek, in 30-inch oak tree root, on west side of road; copper nail and washer, stump painted (erroneously) "U. S. B. M. 2,385.8"....................	2,364.97

Feet.

Clover Lick, 1.29 miles northwest of, in center of ╥-road, on sandstone rock; chiseled square, rock painted "U. S. B. M. 2,348.7" 2,347.83

At Y-road, painted "2,361" 2,359.9

Clover Lick, at, B. M. stamped W. Va. 1921 H 155" (destroyed, in 1924) 2,289.238

DURBIN QUADRANGLE: POCAHONTAS AND RANDOLPH COUNTIES.

(Latitude 38° 30′-38° 45′; Longitude 79° 45′-80° 00′).

Primary leveling by E. E. Harris in 1921:

From Beulah, Elkins Quadrangle, south-southwest along Western Maryland Railroad to Durbin, thence along highways east to Bartow, thence northeast into Spruce Knob Quadrangle.

Beulah, 0.89 mile southwest of, 2.39 miles northeast of **Wildell**, west side of track, 250 feet south of mile-post C 142/D 18, on top of outcrop of rock; chiseled square, telegraph-pole marked "U. S. 3,114.4 B. M." 3,114.74

Wildell, 1.19 miles northeast of, west side of track, center of big cut, on ledge of rock, at base of cliff; chiseled square, rock cliff marked "U. S. 3,108.8 B. M." 3,109.08

Wildell, in front of station-sign; top of near rail, "3,056.4" marked on tie 3,056.7

Wildell, 4 feet east of station-sign, in top of concrete post; bronze tablet stamped "3056 W. Va. 1921 H 116", sign-post marked "U. S. 3,055.6 B. M." 3,055.871

Witness bench mark, 68.7 feet south 60° west of tablet, in top of square-shaped post, at southeast corner of station platform; copper nail and washer 3,056.24

Wildell, 1.03 miles southwest of, east side of track, in west root of large stump; copper nail and washer, telegraph-pole marked "U. S. 3,029.8" B. M 3,030.05

Wildell, 2.06 miles southwest of, 2,760 feet northeast of mile-post C 147/D 13, west side of track, on ledge of rock; chiseled square, rock marked "U. S. 3,021.7 B. M." 3,021.96

Wildell, 2.97 miles southwest of, 2.18 miles northeast of May, 20 feet west of track, in center of small shelf, at base of rock cliff; bronze tablet stamped "3011 W. Va. 1921 H 117", rock cliff marked "U. S. 3,011.2 B. M." 3,011.443

Witness bench mark, 53 feet south 20° west of tablet, on top of boulder; chiseled square 3,008.92

	Feet.
May, 1.21 miles northeast of, 20 feet north of track, at west end of big cut, on top of pointed boulder; chiseled square, boulder marked "U. S. 2,983 B. M."	2,983.28
May, 0.49 mile north of, 650 feet south of mile-post C 149/D 11, east side of track, in top face of stone coping of northeast corner of concrete abutment to railroad trestle; chiseled square, guard-rail marked "U. S. 2,965.4 B. M."	2,965.67
May, in front of station-sign, "2,959.6" marked on tie; top of near rail	2,959.9
May, 0.42 mile south of, 240 feet north of mile-post C 150/D 10, west of track, on top of ledge of rock, at base of cliff; chiseled square, rock cliff marked "U. S. 2,953.7 B. M."	2,954.00
May, 0.72 mile south of, west side of track, in top face of ledge of rock at base of cliff; bronze tablet stamped "2953 W. Va. 1921 H 118", rock marked "U. S. 2,952.1 B. M."	2,952.881
Witness bench mark, 42.2 feet north 30° west of tablet, on rock ledge; chiseled square	2,952.34
May, 1.78 miles south of, 0.38 mile south of mile-post C 151/D 9, east side of track, inside of curve in track, on top face of rock ledge; chiseled square, rock marked "U. S. 2,945.9 B. M."	2,946.20
May, 2.73 miles south of, 0.34 mile south of mile-post C 152/D 8, west side of track, in south root of large cedar stump; copper nail and washer, stump marked "U. S. 2,927.7 B. M."	2,927.99
May, 3.2 miles south of, 1,000 feet north of mile-post C 153/D 7, in west end of south stone abutment to railroad trestle over Little River of West Fork of Greenbrier River; chiseled square, abutment marked "U. S. 2,916.7 B. M."	2,916.98
May, 3.86 miles south of, 4.61 miles north of **Olive**, 0.46 mile south of mile-post C 153/D 7 (west) east side track, in top of large flat boulder; bronze tablet stamped "2902 W. Va. 1921 H 119", boulder marked "U. S. 2,902.2 B. M."	2,902.432
Witness bench mark, 39.8 feet north 45° west of tablet, on top of small boulder; chiseled square	2,901.80
Olive, 3.10 miles north of, west side of track, in north end of west abutment of stone culvert; chiseled square, culvert marked "U. S. 2,874.6 B. M."	2,874.90
Olive, 2.28 miles north of, west side of track, at north end of cut, on top of flat rock; chiseled square, rock marked "U. S. 2,864.8 B. M."	2,865.09

	Feet.
Olive, 1.89 miles north of, east side of track, on top face of large ledge of rock; chiseled square, telegraph-pole marked "U. S. 2,844.4 B. M."	2,844.68
Olive, 1.31 miles northeast of, 1,200 feet north of mile-post C 157/D 3, east side of track, in top of large sheet of rock; bronze tablet stamped "2824 W. Va. 1921 H 120", rock marked "U. S. 2,823.6 B. M."	2,823.818
Witness bench mark, 43 feet south 75° west of tablet, on top of boulder; chiseled square	2,823.53
Olive, 0.48 mile northeast of, west side of track, in top of large stump; copper nail and washer, telegraph-pole marked "U. S. 2,797 B. M."	2,797.24
Olive Station, in front of station-sign; top of near rail, end of tie marked "2,787"	2,787.2
Olive, 280 feet east of station, on stone coping of south end of abutment to railroad trestle over Mountain Lick Creek; chiseled square, stone marked "U. S. 2,784.9 B. M."	2,785.14
Olive, 0.97 mile southwest of, 1.33 miles northeast of **Durbin,** west side of track, inside of long curve, on top of outcrop of rock; chiseled square, rock marked "U. S. 2,760 B. M."	2,760.26
Durbin, 0.63 mile west of, known as **West Durbin,** on west edge of road, just south of railroad crossing, in top of large stone, in retaining wall to approach to bridge over Greenbrier River; chiseled square, marked "2,731.3"	2,731.57
Durbin, 0.63 mile west of, known as **West Durbin,** in top of west end of north abutment to highway bridge over West Fork of Greenbrier River; chiseled square, guard-rail marked "U. S. 2,732.1 B. M."	2,732.32
Durbin, in center of large stone on east side of entrance to Durbin Bank; bronze tablet stamped "2730 W. Va. 1921 H 121"	2,730.480
Witness bench mark, 83.5 feet east of tablet, on stone curbing; chiseled square	2,730.13
Durbin, 0.94 mile east of, on west edge of road to Pocahontas Tanning Company, between rails, in east end of sill at cattle-guard; copper nail and washer, telegraph-pole marked "U. S. 2,736.1 B. M."	2,736.32
Durbin, 1.65 miles east of, 0.76 mile west of **Bartow,** 60 feet east of mile-post W 97, at cattle-guard, in east end of sill between rails; copper nail and washer, telegraph-pole marked "U. S. 2,751.2 B. M."	2,751.48

	Feet.
Bartow, 800 feet west of station, at crossing of railroad and county road, 125 feet north by 120 feet east of road, in top of outcrop of rock, on side of hill; bronze tablet stamped "2872 W. Va. 1921 H 122"........	2,782.361
Witness bench mark, 19.3 feet north 80° west of tablet, on top of outcrop of rock; chiseled square........	2,783.01
Bartow, in front of station; top of near rail, end of tie marked "U. S. 2,774 B. M."........	2,774.1
Bartow, 0.72 mile northeast of, 20 feet west of cattle-guard, north side of track, on top of 15-inch corrugated drain pipe; chiseled square, cattle-guard marked "U. S. 2,795.6 B. M."........	2,795.86
Bartow, 1.28 miles northeast of, 1.51 miles southwest of **Winterburn Station (Thornwood P. O.)**, 70 feet south of railroad, west edge of county road, in west end of north abutment of bridge over East Fork of Greenbrier River; chiseled square, bridge rail marked "U. S. 2,810 B. M."..	2,810.55

From Bartow southeast along highways into Spruce Knob Quadrangle near its southwest corner.

Bartow, 0.71 mile southeast of, on south edge of road, 100 feet east of highway bridge over East Fork of Greenbrier River, 100 feet west of crossroads, in west root of 20-inch maple tree; copper nail and washer, fence-post marked "U. S. 2,782.8 B. M."........	2,783.09
Bartow, 1.40 miles southeast of, on west edge of sharp turn in road, on north edge of lane through gate, in center of large stump; copper nail and washer, telephone-pole marked "U. S. 2,973.8 B. M."........	2,973.93
Bartow, 2.26 miles southeast of, on south edge of road on west edge of lane along top of spur, in east root of 40-inch elm tree; copper nail and washer, tree marked "U. S. 3,261.4 B. M."........	3,261.43

(The 5 following levels are on Spruce Knob Quadrangle):

Bartow, 3.08 miles southwest of, on north edge of road, on top of ledge of rock; chiseled square, telephone-pole marked "U. S. 3,523.7 B. M."........	3,523.66
Bartow, 3.95 miles southeast of, 40 feet west of road center, in saddle of road, set in top of concrete post; bronze tablet stamped "3625 W. Va. 1921 H 128", telephone-pole marked "U. S. 3,624.7 B. M."........	3,624.617
Witness bench mark, 40.2 feet south of tablet, in west root of 12-inch oak tree; copper nail and washer........	3,624.59
Bartow, 4.81 miles southwest of, on west edge of road, at foot of hill, across road from house, in west root of 20-	

Feet.

inch sugar tree; copper nail and washer, telephone-pole marked "U. S. 3,696.5 B. M."........................... 3,696.41

Bartow, 5.4 miles southeast of, in sharp turn in road, 30 feet north of lane, in east root of 12-inch oak tree; copper nail and washer, mail-box post marked "U. S. 3,906.8 B. M.".. 3,906.67

From Durbin south along Western Maryland Railroad into Cass Quadrangle.

Durbin, in center of large stone at southeast corner of building; bronze tablet stamped "2730 W. Va. 1921 H 121".. 2,730.480

Durbin, 0.50 mile southwest of, at new Chesapeake and Ohio Railroad trestle over West Fork of Greenbrier River, in south end of west stone abutment; chiseled square, rail of bridge marked "U. S. 2,720.8 B. M."............. 2,721.01

Durbin, 0.98 mile southwest of, 5 feet east of track, near south end of long curve in track, on top near end of 15-inch drain pipe; chiseled square, pipe marked "U. S. 2,708.1 B. M."..................................... 2,708.33

Durbin, 1.90 miles southwest of, at crossing of railroad and second-class road, 40 feet east by 10 feet south of, on top of rock flush with ground; chiseled square, telephone-pole marked "U. S. 2,685 B. M."................. 2,685.19

Durbin, 2.75 miles southeast of, 0.61 mile northeast of **Boyer Station**, on east edge of railroad right of way, 50 feet north of farm road crossing, in top of boulder; bronze tablet stamped "2672 W. Va. 1921 H 148", telephone-pole marked "U. S. 2,671.7 B. M."........................... 2,671.940

Witness bench mark, 37.5 feet south 80° west of tablet, on top of boulder; chiseled square....................... 2,672.96

Near Boyer Station.

Boyer Station, in front of; top of rail, end of tie marked "U. S. 2,661.5".. 2,661.7

Boyer Station, 0.58 mile southwest of, 10 feet east of track, on top of 15-inch drain pipe; chiseled square, rock marked "U. S. B. M. 2,653.2"......................... 2,653.43

From Durbin northwest along highways to Huttonsville and Mill Creek.

Durbin, 0.63 mile west of, known as **West Durbin**, in top of west end of north abutment to highway bridge over West Fork of Greenbrier River; chiseled square, rail of bridge marked "U. S. 2,732.1 B. M."................. 2,732.32

Durbin, 1.64 miles northwest of, in forks of Y-road, on top of large boulder; chiseled square, log marked "U. S.

	Feet.
3,100.6 B. M."	3,100.67
Durbin, 2.60 miles northwest of, on west edge of road, 150 feet northwest of house, on top of large boulder, in angle in road; chiseled square, boulder marked "U. S. 3,285.1 B. M."	3,285.07
Durbin, 3.35 miles northwest of, 900 feet north of dwelling, 50 feet north of road center, 10 feet west of lone oak tree; set in top near south end of large sandstone boulder; bronze tablet stamped "3299 W. Va. 1921 H 133"	3,298.649
Witness bench mark, 63 feet south 80° east of tablet, on top of boulder; chiseled square	3,297.33
Durbin, 4.10 miles northwest of, on west edge of road, north edge of small run, in line with second-class road, on top of large boulder; chiseled square, boulder marked "U. S. 3,317.9 B. M."	3,317.88
Durbin, 4.94 miles northwest of, on west edge of big bend in road, 20 feet north of small run crossing road, on top of boulder; chiseled square, boulder marked "U. S. 3,625.7 B. M."	3,625.46
Durbin, 5.44 miles northwest of, on north side of road, in gap on top of Back Allegheny Mountain, on top of boulder; chiseled square, telephone-pole marked "U. S. 3,756.8 B. M."	3,756.60
Durbin, 5.77 miles northwest of, 30 feet south of road center, 80 feet west of wooden culvert, in top of large boulder; bronze tablet stamped "3,691 W. Va. 1921 H 134", tree marked "U. S. 3,690.7 B. M."	3,690.512
Witness bench mark, 31 feet north 65° east of tablet, on top of boulder; chiseled square	3,689.13
Durbin, 6.62 miles northwest of, 0.7 mile southeast of **Cheat Bridge P. O.**, on east edge of road, 30 feet north of wooden culvert, on top at south end of long sandstone boulder; chiseled square, boulder marked "U. S. 3,650.8 B. M."	3,650.59
Cheat Bridge P. O., 200 feet south of, 120 feet east of county bridge over Shavers Fork of Cheat River, at east end of grass triangle formed by forks of road, on top of boulder; chiseled square, telephone-pole marked "U. S. 3,557.6 B. M."	3,557.48
Cheat Bridge P. O., 200 feet south of, 25 feet east of road, at forks of, on top of boulder; chiseled square	3,558.86
Cheat Bridge P. O., 1.22 miles northwest of, 100 feet south of road center, 130 feet southwest of gap, 70 feet south of trail along ridge, in top of large boulder; bronze	

	Feet.
tablet stamped "3948 W. Va. 1921 H 135", boulder marked "U. S. 3,948 B. M."	3,947.713
Witness bench mark, 39.6 feet north 75° east of tablet, on top of boulder; chiseled square	3,942.35
Cheat Bridge P. O., 2.12 miles northwest of, on south edge of road, at west end of big bend in road, on east edge of branch of Red Run (of Shavers Fork), on top of boulder; chiseled square, boulder marked "U. S. 3,728.2 B. M."	3,728.10
Cheat Bridge P. O., 3.25 miles northwest of, on north edge of road, west edge of path north, 30 feet west of log culvert, on top of boulder; chiseled square, boulder marked "U. S. 3,745 B. M."	3,744.89
Cheat Bridge P. O., 4.23 miles northwest of, 25 feet south of road center, near west end of gap, on top of mountain at **Cromer Top**, in top of sandstone boulder; bronze tablet stamped "3798 W. Va. 1921 H 136", boulder marked "U. S. 3,798.4 B. M."	3,798.181
Witness bench mark, 25.9 feet north 60° west of tablet, on top of boulder; chiseled square	3,796.52
Cheat Bridge P. O., 5.26 miles northwest of, on east edge of road, 40 feet north of mile-post "Elkins 26", and on north edge of run, on top of large boulder; chiseled square, boulder marked "U. S. 3,413.3 B. M."	3,413.28
Cheat Bridge P. O., 6.16 miles northwest of, on east edge of road, at sharp turn in road, on top face of lower ledge of rock, at base of cliff; chiseled square, rock marked "U. S. 3,085 B. M."	3,085.19
Cheat Bridge P. O., 6.89 miles northwest of, 6.35 miles southeast of **Huttonsville**, 30 feet west of road center, 100 north of sharp turn in road just north of run, about 250 feet north of shack, on side of hill, in top of large boulder; bronze tablet stamped "2814 W. Va. 1921 H 137", tree marked "U. S. 2,814.1 B. M."	2,814.378
Witness bench mark, 31.4 feet west of tablet, on top of large boulder; chiseled square	2,809.05
Huttonsville, 5.36 miles southeast of, on west edge of road, 100 feet south of gate, on top face of ledge of rock; chiseled square, rock marked "U. S. 2,516.9 B. M."	2,517.28
Huttonsville, 4.37 miles southeast of, 1,000 feet east of **Riffle Chapel**, 25 feet south of road center, 100 feet east of wooden bridge over McGee Run, in west root of 15-inch walnut tree; copper nail and washer, tree marked "U. S. 2,331.1 B. M."	2,331.67
Huttonsville, 3.45 miles southeast of, 70 feet south of road center, 60 feet west of Riffle Creek, 700 feet west of	

	Feet.
mouth of Laurel Run, in top of concrete post; bronze tablet stamped "2229 W. Va. 1921 H 138", fence marked "U. S. 2,228.6 B. M."	2,229.112
Witness bench mark, 34 feet south 75° west of tablet, on top of flat boulder; chiseled square	2,229.37
Huttonsville, 2.55 miles southeast of, on south edge of road, 400 feet east of dwelling, in west root of 20-inch walnut tree; copper nail and washer, tree marked "U. S. 2,154 B. M."	2,154.60
Huttonsville, 1.86 miles southeast of, on east edge of road, on north edge of lane, northeast up hillside, on top at end of 15-inch drain pipe; chiseled square, rock marked "U. S. 2,110.6 B. M."	2,110.95
Huttonsville, 1.33 miles southeast of, 30 feet west of main road, 30 feet south of cross lane, in corner of pasture, set in top of concrete post; bronze tablet stamped "2060 W. Va. 1921 H 129"	2,060.417
Witness bench mark, 35.6 feet north 10° west of tablet, in south root of 15-inch maple tree; copper nail and washer	2,060.62
Huttonsville, 0.45 mile south of, at southeast corner of new steel bridge over Tygart River, on top of large stone; chiseled square, marked "U. S. 2,029.9 B. M."	2,030.05
Huttonsville, in front of station; top of near rail, end of tie marked "U. S. 2,023.9"	2,023.9
Huttonsville, 0.51 mile north of, 0.76 mile south of **Mill Creek,** on south side of farm road crossing track, at cattle-guard, in east end of stringer between rails of narrow-gage railroad, just east of Western Maryland Railroad; copper nail and washer, fence-post marked "U. S. 2,016.6 B. M."	2,016.52
Mill Creek, in front of station; top of rail	2,016.1
Mill Creek, Western Maryland Railroad bridge over Tygart River, in stone seat of southwest corner of; bronze tablet stamped "2,013" (Bull. 632, p. 37)	2,013.047

From Cheat Bridge southwest along Western Maryland Railroad into Cass Quadrangle.

Cheat Bridge, 200 feet south of post-office, 120 feet east of steel bridge over Shavers Fork of Cheat River, at east side of triangle formed by road forks, on top of boulder; chiseled square, marked "U. S. 3,557.6 B. M."	3,557.48
Cheat Bridge P. O., 0.90 mile southwest of, at crossing of railroad and dirt road leading to Cheat Bridge Club House, 10 feet east by 25 feet north of, on top of boulder; chiseled square, boulder marked "U. S. 3,565 B. M."	3,564.94

	Feet.
Cheat Bridge P. O., 1.92 miles southwest of, 10 feet west of track, at east end of big cut, on north end of long boulder; chiseled square, boulder marked "U. S. 3,580.6 B. M."	3,580.56
Cheat Bridge P. O., 2.62 miles southwest of, 1,400 feet south of mile-post C 21, west side of track, in top of large boulder; bronze tablet stamped "3588 W. Va. 1921 H. 140", boulder marked "U. S. 3.588.4 B. M."	3,588.393
Witness bench mark, 19 feet south 80° west of tablet, on top at east end of boulder; chiseled square	3,588.56
Cheat Bridge P. O., 3.53 miles southwest of, 10 feet east of track, on top of boulder; chiseled square, boulder marked "U. S. 3,601.3 B. M."	3,601.24
Cheat Bridge P. O., 4.35 miles southwest of, 0.30 mile north of water-tank, 50 feet north of mile-post C 19, in top face of stringer between rails of trestle; copper nail and washer, stringer marked "U. S. 3,612.1 B. M."	3,612.10
Cheat Bridge P. O., 5.35 miles southwest of, 30 feet north of mile-post C 18, 20 feet west of track, in top of stump; copper nail and washer, stump marked "U. S. 3,621.5 B. M."	3,621.50
Cheat Bridge P. O., 6.21 miles southwest of, 950 feet north of mile-post C 17, 10 feet east of track in top near east end of large boulder; bronze tablet stamped "3639 W. Va. 1921 H 141", boulder marked "U. S. 3,638.5 B. M."	3,638.506
Witness bench mark, 56 feet south 20° west of tablet, on top of boulder; chiseled square	3,635.99
Cheat Bridge P. O., 7.09 miles southwest of, 1,450 feet north of mile-post C 16, 20 feet south of spring, 10 feet west of track, on top of large boulder; chiseled square, boulder marked "U. S. 3,662.8 B. M."	3,662.76
Cheat Bridge P. O., 8.16 miles southwest of, 6.80 miles north of **Spruce P. O.**, 700 feet north of coaling station at **Hopkins**, 10 feet west of track, on top of large boulder; chiseled square, boulder marked "U. S. 3,682.8 B. M."	3,682.83
Spruce P. O., 5.77 miles north of, 1,000 feet north of mile-post C 14, 530 feet south of shack, 10 feet from track, in top of large boulder; bronze tablet stamped "3702 W. Va. 1921 H 142", boulder marked "U. S. 3,701.8 B. M."	3,701.770
Witness bench mark, 158.8 feet south 45° east of tablet, on top of large boulder; chiseled square	3,702.46
Spruce P. O., 4.75 miles north of, 1,200 feet north of mile-post C 13, 10 feet west of track, on top of large boulder; chiseled square, boulder marked "U. S. 3,728.9 B. M."	3,728.95

Feet.

Spruce P. O., 3.84 miles north of, 1,200 feet south of railroad trestle over Shavers Fork of Cheat River, 40 feet south of shack, 10 feet east of track, on top of large boulder; chiseled square, boulder marked "U. S. 3,738.1 B. M.".. 3,738.16

Spruce P. O., 2.79 miles north of, 1,250 feet north of milepost C 11, 20 feet east of track, in top of boulder; bronze tablet stamped "3769 W. Va. 1921 H 143", boulder marked "U. S. 3,769.1 B. M."........................... 3.769.130

Witness bench mark, 35.4 feet south of tablet, on top of boulder; chiseled square.............................. 3,768.29

Spruce P. O., 1.84 miles north of, 1,500 feet north of milepost C 10, 700 feet north of railroad trestle over Shavers Fork of Cheat River, 10 feet east of track. on top of large boulder; chiseled square, boulder marked "U. S. 3,797.4 B. M.".. 3,797.46

Spruce P. O., 0.77 mile north of, 110 feet south of stream crossing, 10 feet east of track, on top of boulder; chiseled square, boulder marked "U. S. 3,829.5 B. M.".. 3,829.52

HIGHTOWN QUADRANGLE: POCAHONTAS COUNTY.

(Latitude 38° 15′-38° 30′; Longitude 79° 30′-79° 45′).

Primary leveling by E. E. Harris in 1921:

From near southwest corner of Spruce Knob Quadrangle along highways south to Top of Allegheny, thence through northwest part of quadrangle into Cass Quadrangle.

Bartow, 7.74 miles southwest of, on south edge of sharp turn in road, 60 feet west of second-class road to east, in east root of tall oak stump; copper nail and washer, tree marked "U. S. 3,963.8 B. M.".......................... 3,963.68

Bartow, 8.44 miles southeast of, at **Top of Allegheny**, in southwest corner of T-road west, along Buffalo Ridge, in corner of pasture field, set in top of concrete post; bronze tablet stamped "4199 W. Va. 1921 H 130", fencepost marked "U. S. 4,199.5 B. M."..................... 4,199.312

Witness bench mark, 83.6 feet south of tablet, on top of boulder; chiseled square........................... 4,202.7

Top of Allegheny, 0.73 mile southwest of. on east edge of road, west edge of dim road, in west root of 12-inch oak tree; copper nail and washer, tree marked "U. S. 4,199.7 B. M.".. 4,199.48

Top of Allegheny, 1.46 miles southwest of, on east edge of road and south edge of lane through gate, in west root of 15-inch oak tree; copper nail and washer, fence-rail marked "U. S. 4,112.1 B. M."........................... 4,111.93

	Feet.
Top of Allegheny, 2.22 miles southwest of, on east edge of road, at forks of private lane southeast, on Buffalo Ridge, in west root of 20-inch chestnut oak tree; copper nail and washer, gate-post marked "U. S. 4,146.3 B. M." (eastern edge of Cass Quadrangle)	4,146.13

LOBELIA QUADRANGLE: GREENBRIER, POCAHONTAS, WEBSTER, AND NICHOLAS COUNTIES.

(Latitude 38° 00′-38° 15′; Longitude 80° 15′-80° 30′).

Third order leveling by C. F. Shalibo in 1920:

From Marlinton Quadrangle near Locust P. O. (Spice Run) southwest along Chesapeake and Ohio Railroad to point 2.10 miles northeast of Renick, White Sulphur Springs Quadrangle.

Locust P. O. (Spice Run), 4.1 miles southwest of, on Chesapeake and Ohio Railroad, 100 feet northeast of **Droop Mountain Station**, on north side of track, in large boulder; bronze tablet stamped "W. Va. 1920 1,948".....	1,947.867
Locust P. O. (Spice Run), 5.4 miles southwest of, on Chesapeake and Ohio Railroad, at **Rorer Station**, 0.1 mile south of tunnel, 60 feet northeast of station, in base of post; iron spike, painted "1,935.1"..................	1,934.71
Renick, 4.7 miles northeast of, on Chesapeake and Ohio Railroad, 170 feet southwest of **Horrock Station**, at southeast corner of bridge No. 296, in stone coping; chiseled square, painted "1,916.7"......................	1,916.28
Renick, 3.3 miles northeast of, on Chesapeake and Ohio Railroad, 100 feet northwest of **Golden Station**, 30 feet west of track, in large boulder; bronze tablet stamped "W. Va. 1920 1,899".................................	1,898.092
Renick, 2.1 miles northeast of, on Chesapeake and Ohio Railroad, 80 feet southeast of mile-post 27, 30 feet east of track, in base of telephone-pole; iron spike, painted "1,886.0"...	1,885.56

Third order leveling by E. E. Harris in 1921:

From point northeast of Williamsburg in White Sulphur Springs Quadrangle along highways northeast to Friar Hill, thence southeast to Renick.

Williamsburg, 3.3 miles north of, 2 miles southwest of **Friar Hill**, on west edge of road, 60 feet south of crossroads, in east root of 15-inch jack oak tree; copper nail and washer, tree blazed and marked "T. B. M. 2,189.6".....	2,189.61
Friar Hill, 1.1 miles southwest of, on inside of angle in road, 3 feet east of box culvert, on rock boulder; chiseled square, marked "T. B. M. 2,241.9".....................	2,241.17

	Feet.
Friar Hill, in southwest corner of road forks, in top of rock in place; bronze tablet stamped "2352 H 7 1921 W. Va"	2,351.865
Witness bench mark, 36.7 feet north 65° east, in forks of road, in north root of 18-inch oak tree; copper nail and washer..	2,348.90
Friar Hill, 0.8 mile east of, on west edge of road south, opposite forks of road east, in root of 10-inch hickory tree; copper nail and washer, tree blazed and marked "T. B. M. 2,342.8"................................	2,342.82
Friar Hill, 1.5 miles east of, on south edge of road, 30 feet east of lane through gate to farmhouse of J. S. Shafe, on top of rock outcrop; chiseled square, fence railing marked "T. B. M. 2,368.3"...............................	2,368.34
Friar Hill, 3.5 miles east of, 4.8 miles west of **Renick**, at road forks, in southeast corner in top of rock in place; bronze tablet stamped "H 8 1921 W. Va. Elev. 1936"...	1,935.987
Witness bench mark, 43 feet south 80° west, on northwest corner of large flat boulder..........................	1,937.93
Renick, 3.9 miles northwest of, on east side of road, about 150 feet north of ford over Spring Creek, in top of tall stump; copper nail and washer, marked "U. S. B. M. 1,918.9"..	1,918.99

Third order leveling by H. P. Kilby, J. L. Lenovitz, and H. R. Kilmer in 1921:

From Trout P. O. north along highway to Manning Knob.

Trout P. O., at road forks, in Y, top of boulder; chiseled square, painted "2,273.8"..............................	2,273.71
Trout P. O., 1.2 miles north of, at west edge of road, point of ledge; bronze tablet stamped "2522 K 6 W. Va. 1921"	2,521.579
Reference mark, 55 feet south of permanent bench mark, 110 feet west of Little Roaring Creek, top of rock; chiseled square..	2,514.20
Trout, 2.3 miles north of, at point of curve on slope of hill, top of rock at east edge of road; chiseled square, painted "2,928.8"..	2,928.56
Trout, 3.5 miles north of, outcrop of ledge, at west edge of road; chiseled square, painted "3,499.0"................	3,498.48
Trout, 4.2 miles north of, 40 feet west of road, top of large boulder, 3 feet above ground, on sharp curve in road, 30 feet west of fence corner; bronze tablet stamped "3827 K 7 1921"..	3,827.073

Feet.

Reference mark, north 50° east 41.6 feet from permanent bench mark; chiseled square on rock.................. 3,827.61

Trout, 5.3 miles north of, 240 feet north of road to top of mountain, at west edge of road, on boulder; chiseled square, painted "4,085.7"............................ 4,084.73

Richwood, about 12.75 miles southeast of, southwest of Greenbrier road, 795 feet northwest of road to Duo, in rock; aluminum tablet stamped "W. Va. 1921 K Elev. 4117" (set in 1921 0.512 foot above center of hole at site of old tablet, described in Bulletin 632, p. 58).......... 4,117.455

Richwood, about 12.75 miles southeast of, southwest of Greenbrier road, 795 feet northwest of road to Duo, in rock; hole drilled horizontally in vertical face of rock, formerly occupied by tablet (Bulletin 632, p. 58)........ 4,116.943

Reference T. B. M., directly under P. B. M., in point of rock; chiseled square.................................... 4,116.70

Richwood, 12.8 miles south of, at west edge of road, on rock; chiseled square, painted "3,873.6"............... 3,872.69

Richwood, 12 miles south of, at second-class road forks west, top of large boulder, 30 feet west of road; bronze tablet stamped "W. Va. K 8 1921 Elev. 3954"................. 3,953.566

Reference mark, 17.5 feet south of P. B. M., on rock; chiseled square.. 3,951.84

Richwood, 10.9 miles south of, at top of mountain, 10 feet west of road, in top of large rock; chiseled square, painted "3,966.6"...................................... 3,965.68

Richwood, 9.6 miles south of, at old camping ground, in root of 30-inch sugar maple tree, 15 feet east of road; copper nail and washer, painted "3,831.6".................... 3,830.70

Richwood, 9.0 miles south of, on north slope of hill, 15 feet north of Greenbrier road, in top of large boulder; bronze tablet stamped "3843 K 9 1921 W. Va."................. 3,843.280

Reference mark, 25 feet east of P. B. M., on rock; chiseled square.. 3,843.88

(Note: P. B. M. Elev. 3,710,922 feet, which should come between these two B. M's., has been completely destroyed. Bull. 632, p. 58).

Richwood, 7.9 miles south of, point of ledge, at east edge of road; chiseled square, painted "3,678.3"............... 3,677.37

Richwood, 7.2 miles south of, at top of **Manning Knob**, in root of 20-inch oak stump, at west edge of road; copper nail, painted "3,914.5"............................... 3,913.55

Third order leveling by P. E. Davenport in 1922:

From near Richwood (Richwood Quadrangle) southeast along highways to Little Rocky Creek. Spur leveled twice.

	Feet.
Bridge over first creek at west end of, painted "2,336"......	2,336.1
Richwood, 3.52 miles southeast of, 30 feet north 30° east of center of road, 43 feet west of Mr. Cunningham's house, in large sandstone boulder; bronze tablet stamped "W. Va. D Elev. 2360", rock painted "U. S. 2,360.3 B. M."...	2,360.260
Witness mark, 57 feet south of P. B. M., 27 feet southwest of center of road; chiseled square on sandstone boulder..	2,358.26

Third order leveling by P. E. Davenport in 1922:

In front of large boulder, painted "2,413"...................	2,412.9
Richwood, 4.67 miles southeast of, 1.15 miles east of Mr. Cunningham's house, on north bank of Cherry River; on sandstone rock, painted "U. S. 2,442.7 B. M."; chiseled square..	2,442.59
On west bank of creek, painted "2,464"...................	2,464.6
At fence across old grade, painted "2,483"................	2,483.0
Richwood, 5.73 miles southeast of, 15 feet east of bank of river on east margin of old railroad grade, on sandstone boulder, painted "U. S. 2,502.8 B. M."; chiseled square..	2,502.65
Witness mark, in sandstone rock, 60 feet east of B. M., on north bank of river; chiseled square..................	2,536.5
Richwood, 6.31 miles southeast of, 15 feet north of bank of Cherry River, on north margin of old railroad grade, in sandstone boulder; bronze tablet stamped "2535", painted "U. S. 2,535.2 B. M."...........................	2,535.038
Gate to farmhouse, painted "2,546".........................	2,545.6
Richwood, 7.38 miles southeast of, 450 feet west of abandoned house, on south side of old railroad grade, in sandstone rock; chiseled square, painted "U. S. 2,592.7 B. M."...	2,592.49
Richwood, 8.12 miles southeast of, 0.75 mile east of large abandoned house, in sandstone boulder, 30 feet north of old railroad grade; chiseled square, boulder painted "U. S. 2,657.1 B. M."................................	2,656.86
Witness mark, in sandstone rock, on east side of grade; chiseled square....................................	2,717.45
Richwood, 8.74 miles southeast of, on west bank of river, 1.36 miles south of old abandoned house, in large sandstone boulder; bronze tablet stamped "2717"; tree 15 feet south painted "U. S. 2,716.7 B. M."...............	2,716.419

Feet.

From Marlinton Quadrangle along highways west to Lobelia, thence to Jacox, thence west and south to point 3.5 miles east of Friar Hill.

Hillsboro, 3.23 miles west of, on east edge of road, at base of rock cliff, on top of ledge of rock; chiseled square, rock marked "U. S. 2,903.6 B. M."...................... 2,903.36

Hillsboro, 4.15 miles west of, east side of **Caesar Mountain School**, 15 feet south of road center, in top of large sandstone boulder; bronze tablet stamped "2994 W. Va. 1921 H", pole marked "U. S. 2,993.8 B. M."............ 2,993.753

Witness mark, in root of tree, copper nail and washer...... 2,993.94

At ╥-road west, "2,973" marked......................... 2,972.7

Center of railroad crossing, on top of west rail, painted "2,826.6".. 2,826.5

Hillsboro, 5.15 miles west of, 2.30 miles south of ╥-road, in south root of hickory tree, on south side of road; copper nail and washer, tree marked "U. S. 2,698.1 B. M."...... 2,697.99

At Y-road, marked "2,513"............................. 2,512.6

Hillsboro, 6.05 miles west of, 0.85 mile east of **Lobelia**, 40 feet south of center of road, in south root of oak tree, on south margin of road leading to farmhouse; copper nail and washer, elevation painted on tree 80 feet east of bench mark "U. S. 2,531.4 B. M."................... 2,531.29

Center of road, 125 feet west of creek, painted on fence "2,528".. 2,527.9

Witness bench mark, in boulder, on south side of road, 40 feet east of P. B. M.; chiseled square.................. 2,505.64

Lobelia, 190 feet east of post-office, 15 feet south of center of road, in large limestone boulder, in front of small two-room house, rock painted (erroneously) "U. S. 2,605.2 B. M.", bronze tablet stamped "2,505".......... 2,505.114

Bridge, at east end of concrete bridge, painted (erroneously) "2,579".. 2,477.79

Lobelia, 0.77 mile south of, 15 feet south of center of track, 20 feet north of creek, in north root of 10-inch pine tree; copper nail and washer, painted (erroneously) "U. S. 2,594.6 B. M.".. 2,494.53

Center of crossroads, on point of mountain, painted on mailbox post "2,818.6" (painted erroneously)............... 2,718.4

Creek, marked "2,687" (erroneously marked)............... 2,590.0

In front of large oak tree 15 feet west of creek, (erroneously) marked "2,638"...................................... 2,537.7

	Feet.
Lobelia, 2.0 miles south of, 25 feet southwest of road, on west bank of creek, on large boulder; chiseled square, painted "U. S. 2,638.0 B. M." (erroneously marked).....	2,537.86
At gate, (erroneously) marked "2,685"......................	2,585.0
At gate, (erroneously) marked "2,818"......................	2,718.0
Lobelia, 3.17 miles south of, 15 feet east of center of road, in west root of 20-inch chestnut tree; copper nail and washer, tree marked with a white cross, stump on west side of road (erroneously) painted "U. S. 2,812.3 B. M."	2,712.07
Lobelia, 3.48 miles south of, 23 feet east of northwest corner of **Oak Grove School**, in large sandstone rock, rock 10 feet west marked "U. S. 2,776 B. M." (erroneously marked); bronze tablet stamped "2,677"..............	2,676.764
Witness bench mark, in west root of maple tree, 50 feet east of **Oak Grove School** road, 45 feet north of school, 76 feet northwest of tablet; copper nail and washer............	2,676.69
At gate, near church (erroneously) marked "2,812"........	2,709.8
At ╥-road, elevation painted (erroneously) "2,632"..........	2,538.1
Jacox P. O., 600 feet west of, 20 feet east of center of road, in west root of oak tree, marked (erroneously) "U. S. 2,727.3 B. M."; copper nail and washer.................	2,627.13
At ╥-road, painted (erroneously) "2,980"..................	2,882.2
Jacox P. O., 1 mile northwest of, 15 feet south of center of road, in south root of locust tree; copper nail and washer, painted (erroneously) "U. S. 3,144.3" B. M."...	3,044.03
Jacox P. O., 1.14 miles northwest of, on top of mountain, in north root of oak tree, on south side of road, mail-box post on north side of road painted (erroneously) "U. S. 3,346.4 B. M."; copper nail and washer.................	3,246.09
At sharp curve, painted on gate (erroneously) "3,166".....	3,066.1
At gate, (erroneously) painted "3,049"......................	2,949.1
Boggs Run School, 15 feet from southeast corner of school, in large boulder; bronze tablet stamped "2707 W. Va. D", rock painted (erroneously) "U. S. 2,807.5 B. M."....	2,707.264
Witness bench mark, 23 feet southwest of southwest corner of **Boggs Run School**, 53 feet west of bronze tablet, in small rock; chiseled square........................	2,703.56
On bank of Boggs Run at curve in road....................	2,617.5
At gate, painted "2,504".................................	2,503.3

	Feet.
Boggs Run School, 1 mile southwest of, 15 feet north of center of road, 80 feet east of intersection of Two Creek, in sandstone rock; chiseled square, painted "U. S. 2,377.9 B. M."	2,377.70
In front of stiles, in front of church, marked "2,330"	2,329.5
At gate, marked "2,313"	2,312.8
Sugar Grove School, 221 feet N. 40° W. of, 20 feet east of center of road, on west side of Robbins Run, in large sandstone rock; bronze tablet stamped "W. Va. 2226 D", rock marked with a white cross, barn painted "U. S. 2,226.2 B. M."	2,226.930
Witness bench mark, 102 feet south of tablet, in west root of maple tree; copper nail and washer	2,227.10
At gate, marked "2,215"	2,215.0
Sugar Grove School, 1.14 miles south of, in large boulder, on west margin of road; chiseled square, rock painted "U. S. 2,173.2 B. M."	2,172.92
Sugar Grove School, 1.89 miles south of, 60 feet north of road fork, on large limestone boulder, on east margin of road; chiseled square, painted "U. S. 2,123.6 B. M."	2,123.37
At corner of Boice store, painted "2,070"	2,069.8
At T-road north, painted "2,060"	2,060.0
Sugar Grove School, 2.81 miles south of, at fork of Y-road, on west side, in sandstone rock; chiseled square, painted "U. S. 2,051.9 B. M."	2,051.69
Large white house, 300 feet east of, 350 feet north of road, in large limestone boulder, on side of hill, rock marked with an arrow; barn painted "U. S. 2,012.1 B. M."; bronze tablet stamped "2,012"	2,011.844
Witness bench mark, 28 feet northeast from tablet, in small limestone rock; chiseled square	2,009.45
Dry Run, 2.28 miles south of, 0.97 mile south of bench mark in Mr. Bearden's yard; on limestone boulder, on east side of railroad; chiseled square, tie is marked "U. S. 1,983.5 B. M." with kiel	1,983.23
At east end of trestle	1,971.8
At switch near camp	1,947.6
At west end of trestle	1,939.7
At road crossing	1,936.2

From Lobelia northwest along highways 3.75 miles. (Spur line leveled twice by P. E. Davenport in 1922).

	Feet.
Lobelia, 1.03 miles northwest of, 30 feet west of east rail, in root of old stump; copper nail and washer, tie painted "U. S. 2,565.9 B. M."	2,565.91
Lobelia, 2 miles northwest of, 5 feet west of track, on west side of large sandstone boulder, 100 feet west of unpainted house; chiseled square, painted "U. S. 2,666.6 B. M."	2,666.50
Lobelia, 3.25 miles north of, 65 feet south of center of track, 0.3 mile west of large white house; in large sandstone boulder; bronze tablet stamped "W. Va. D Elev. 2877"	2,876.551
Witness bench mark, on sandstone rock, 70 feet west of bench mark, 10 feet south of track; chiseled square	2,876.95
Lobelia, 3.75 miles northwest of, south side of track, 20 feet west of switch, in sandstone boulder; chiseled square, painted "U. S. 3,045.7 B. M."	3,046.56

MARLINTON QUADRANGLE: POCAHONTAS AND GREENBRIER COUNTIES.

(Latitude 38° 00′-38° 15′; Longitude 80° 00′-80° 15′).

(Permanent bench marks stamped in 1924 by G. E. Sisson).

Primary leveling by C. F. Shalibo in 1920:

From point 4.60 miles north of Sue P. O., Callaghan Quadrangle, north and west along highways and Chesapeake and Ohio Railroad to point 1.90 miles southwest of Locust P. O. (Spice Run), Lobelia Quadrangle.

Sue P. O., 4.6 miles north of, on Little Creek road, 50 feet north of small bridge over stream, 0.2 mile southeast of deserted farmhouse, 10 feet east of road, in root of large oak tree; copper nail, painted "2,334.3"	2,334.04
Sue P. O., 5.4 miles north of, on Little Creek road, 100 feet northwest of house, 10 feet south of road, in root of oak tree; copper nail, painted "2,463.1"	2,462.86
Sue P. O., 7.0 miles northwest of, on old trail on Spice Run, 0.2 mile west of old Coulter place, 15 feet west of road, in large rock; bronze tablet stamped "W. Va. 1920 2,334"	2,334.272
Locust P. O. (Spice Run), 3.0 miles southeast of, on Spice Run, along old trail, at old lumber camp site, 20 feet west of small building, on east edge of trail, in root of tree; copper nail, painted "2,220.6"	2,220.32
Locust P. O. (Spice Run), 1.4 miles southeast of, on Spice Run, along old trail, 100 feet west of stream crossing, 0.5	

Feet.

mile east of Greenbrier River, on west edge of trail, in root of tree; copper nail, painted "2,030.0".............. 2,029.68

Locust P. O. (Spice Run), 0.9 mile southwest of, on Chesapeake and Ohio Railroad, on east side of track, at small culvert over drain, in stone coping; bronze tablet stamped "W. Va. 1920 1,978"........................ 1,975.559

Locust P. O. (Spice Run), 1.9 miles southwest of, on Chesapeake and Ohio Railroad, on west side of track, in ledge of rock; chiseled square, painted "1,977.9"............. 1,977.52

Primary leveling by E. E. Harris in 1921:

From Mingo Quadrangle near its southeast corner along Chesapeake and Ohio Railroad to Spice Run (Locust P. O.) near southwest corner of quadrangle.

August, top of rail in front of station-sign, end of tie marked "U. S. 2,165.6".. 2,165.9

August, 160 feet south of station, 25 feet east of track, in northeast corner of small wooden bridge over drain; copper nail and washer, gate-post marked "U. S. B. M. 2,164.4".. 2,164.71

August, 0.78 mile southwest of, 3.35 miles northeast of **Marlinton,** at **Knapp,** 70 feet north of road crossing, 10 feet east of track, in east end of south bridge seat of railroad trestle No. 595 over Halfway Run; chiseled square, bridge seat of bridge marked "U. S. B. M. 2,154.9"....... 2,155.15

Marlinton, 2.51 miles northeast of, 2,000 feet south of mile-post W 59, 15 feet east of track, in top face of rock ledge, at base of cliff; bronze tablet stamped "W. Va. 1921 H 159 2148"; rock marked "U. S. B. M. 2,147.7".... 2,148,043

Witness bench mark, 76.8 feet west of tablet, on top of boulder; chiseled square............................ 2,146.48

Marlinton, 1.56 miles north of, 1,650 feet south of mile-post W 58, 10 feet east of track, on top face of large rock ledge; chiseled square, rock marked "U. S. B. M. 2,138.7" 2,139.00

Marlinton, 0.63 mile northeast of, 30 feet north of target-switch, on bank, 15 feet west of track, on top of large boulder; chiseled square, boulder marked "U. S. B. M. 2,135.8".. 2,136.12

Marlinton, in front of station; top of near rail of main-line track, end of tie marked "U. S. 2,127.1"................ 2,127.4

Marlinton, 950 feet west of railroad station, 50 feet south of concrete road and 60 feet east of east end of concrete highway bridge over Greenbrier River; bronze tablet stamped "W. Va. 1921 H 160 2122", telephone-pole marked "U. S. B. M. 2,122.2"........................ 2,122.574

	Feet.
Witness bench mark, 58.3 feet south 70° west of tablet, in east root of 12-inch yellow poplar tree; copper nail and washer..	2,123.19
Marlinton, 900 feet west by 1,350 feet south of station, 154 feet west of road center, 6.1 feet north of shed at rear of home of R. B. Slaven, set in top of large concrete post; bronze tablet stamped "W. Va. 1921 H 2124", telephone-pole marked "U. S. B. M. 2,123.5"......................	2,123.828
Witness bench mark, 111.9 feet north 5° west of tablet in south root of 30-inch tree; copper nail and washer.....	2,124.15
Stillwell, top of near rail in front of station-sign, end of tie marked "U. S. 2,127.6"...............................	2,127.9
Stillwell, 190 feet south of station, east side of track, in east end of bridge seat of railroad trestle No. 550; chiseled square, guard-rail of trestle marked "U. S. B. M. 2,125.6".......................................	2,125.94
Stillwell, 1 mile southwest of, 1.90 miles northeast of **Buckeye,** 370 feet north of mile-post W 54, in east end of south bridge seat of railroad trestle No. 541 over Sunday Lick Run; chiseled square, guard-rail of trestle marked "U. S. B. M. 2,115.6"...............................	2,115.91
Buckeye, 1.11 miles northeast of, 1,500 feet north of mile-post W 53, 20 feet east of track, on top face of ledge of rock, at base of cliff; chiseled square, rock marked "U. S. B. M. 2,115.2".......................................	2,115.52
Buckeye, 0.58 mile northeast of, 28.6 feet south of track, in center of top of large boulder; bronze tablet stamped "W. Va. 1921 H 186 2115", boulder marked "U. S. B. M. 2,114.6"..	2,114.944
Witness bench mark, 52.3 feet north of tablet, on top of large boulder; chiseled square..............................	2,108.24
Buckeye, 140 feet north of station, in southeast corner of crossing of railroad and dirt road, 50 feet east by 30 feet south of, in west root of 20-inch oak tree; copper nail and washer, tree marked "U. S. B. M. 2,105.3"......	2,105.57
Buckeye, in front of station; top of near rail, end of tie marked "U. S. 2,106.9"................................	2,107.2
Buckeye, 0.76 mile southeast of, 2,500 feet north of mile-post W 51, in east end of south bridge seat of railroad trestle No. 514; chiseled square, guard-rail of trestle marked "U. S. B. M. 2,099.5".........................	2,099.81
Buckeye 1.65 miles south of, 2,460 south of mile-post W 51, 15 feet east of track, 10 feet south of small culvert, on top of large boulder; chiseled square, boulder marked "U. S. B. M. 2,091.8".................................	2,092.12

	Feet.
Buckeye, 2.36 miles southwest of, 0.56 feet northeast of Violet, 1,040 feet south of mile-post W 50, 15 feet east of track, on top of boulder; chiseled square, boulder marked "U. S. B. M. 2,088.4"	2,088.69
Violet, in front of station-sign; top of near rail, end of tie marked "U. S. 2,085.5"	2,085.8
Violet, 840 feet south of station, 20 feet east of track, in top of boulder; bronze tablet stamped "W. Va. 1921 H 187 2084", boulder marked "U. S. B. M. 2,083.7"	2,084.005
Witness bench mark, 145 feet north 50° east of tablet, on top of boulder; chiseled square	2,084.29
Watoga, in front of station-sign; top of near rail, end of tie marked "U. S. 2,079.5"	2,079.8
Watoga, 920 feet south of station, at railroad trestle No. 479, in northeast corner of bridge seat; chiseled square, rail of trestle marked "U. S. B. M. 2,077"	2,077.31
Watoga, 2.27 miles southwest of track, 250 feet south of road crossing, on top of boulder; chiseled square, boulder marked "U. S. B. M. 2,065.4"	2,065.75
Seebert, 0.64 mile north of, at railroad trestle No. 464 over Stamping Creek, in east end of south bridge seat top; chiseled square, abutment marked "U. S. B. M. 2,061.8"	2,062.08
Seebert, in front of station; top of near rail of main-line track, end of tie marked "U. S. 2,059.1"	2,059.4
Seebert, 150 feet southeast of station, 60 feet east of track, in top of large boulder; bronze tablet stamped "W. Va. 1921 H 188 2049", telegraph-pole marked "U. S. B. M. 2,049.4"	2,049.741
Witness bench mark, 54.3 feet south 40° west of tablet, on top of boulder; chiseled square	2,051.42
Seebert, 1.21 miles southwest of, 30 feet north of track, 60 feet west of gate to pasture, in top of large stump; copper nail and washer, fence-post marked "U. S. B. M. 2,050.9"	2,051.26
Seebert, 2.11 miles south of, 1.11 miles northeast of **Kennison**, 10 feet west of track, 80 feet north of cattle-guard, on top face of ledge of rock, at base of cliff; chiseled square, rock marked "U. S. B. M. 2,043.3"	2,043.64
Kennison, 840 feet east of station, 240 feet east of road crossing, 29.4 feet north of track, in top of large sandstone boulder; bronze tablet stamped "W. Va. 1921 H 189 2036", boulder marked "U. S. B. M. 2,035.9"	2,036.247
Witness bench mark, 137.2 feet north 50° west of tablet, on top of boulder; chiseled square	2,033.33

	Feet.
Kennison, in front of station, end of tie marked "U. S. 2,033.8", top of near rail..............................	2,034.2
Kennison, 0.84 mile west of, 70 feet east of **Burnsides**, north side of track, in north end of west stone bridge seat of railroad trestle No. 417; chiseled square, guard-rail of trestle marked "U. S. B. M. 2,025.2"..................	2.025.57
Burnsides, in front of station; top of near rail, end of tie marked "U. S. 2,028.4"................................	2,028.8
Burnsides, 0.80 mile west of, 70 feet east of **Mill Run Station**, in south end of east bridge seat of railroad trestle No. 409; chiseled square, guard-rail of trestle marked "U. S. B. M. 2,022.6"......................................	2.022.93
Mill Run, in front of station; top of near rail, end of tie marked "U. S. 2,025".................................	2,025.3
Mill Run, 1.17 miles southeast of, 0.43 mile north of **Denmar**, 10 feet west of track, on top of 15-inch drain pipe; chiseled square, rock marked "U. S. B. M. 2,017"...........	2,017.42
Denmar, in front of station-sign; top of near rail, end of tie marked "U. S. 2,015.4"...............................	2,015.8
Denmar, 150 feet southwest of station, 100 feet west of track. southeast corner of large concrete block; bronze tablet stamped "W. Va. 1921 H 190 2023", block marked "U. S. B. M. 2,023.1".......................................	2,023.412
Witness bench mark, 51.4 feet south 15° west of tablet, in top of stump; copper nail and washer..................	2.021.24
Denmar, 0.88 mile southwest of, 100 feet west of **Beard Station**, north side of track, in northwest corner of station platform, top of iron bolt, painted white, telegraph-pole marked "U. S. B. M. 2,010.1".........................	2,010.44
Beard, in front of station; top of near rail, end of tie marked "U. S. 2,009.7".................................	2,010.00
Beard, 0.92 mile southwest of, 0.18 mile northeast of **Locust Station**, west side of track, in west end of south bridge seat of railroad trestle No. 376 over Locust Creek; chiseled square, guard-rail marked "U. S. B. M. 1,997.8"....	1,998.16
Locust Station, in front of station-sign; top of rail. end of tie marked "U. S. 1,998.7".............................	1,999.1
Locust Station, 0.65 mile south of, 0.59 mile north of **Spice Run (Locust P. O.)**, west side of track, 360 feet south of run, on top of boulder; chiseled square; rock marked "U. S. B. M. 1,993.6".................................	1,993.97
Spice Run (Locust P. O.), in front of station-sign; top of rail, end of tie marked "U. S. 1,989.5"..................	1,989.9

	Feet.
Spice Run (Locust P. O.), 100 feet southwest of station, west of track, inside fence line, in south root of trunk of tree; copper nail and washer, tree marked "U. S. B. M. 1,987"..	1,987.37
Spice Run (Locust P. O.), 0.69 mile south of station, east of track, in center of stone coping of culvert; bronze tablet stamped "1976"................................	1,975.559

From Warm Springs Quadrangle southwest along highway down Anthony Creek in southeast part of quadrangle into Callaghan Quadrangle.

Trainer P. O., 2.96 miles northeast of, in southeast corner of cattle-guard, between rails of log railroad, in end of stringer; copper nail and washer, fence marked "U. S. B. M. 2,371.1"....................................	2,371.47
Trainer P. O., 2.38 miles northeast of, 40 feet west of road center, on south bank of Anthony Creek, set in top of concrete post; bronze tablet stamped "W. Va. 1921 H 172 2345", corner fence-post marked "U. S. B. M. 2,345"....	2,345.410
Witness bench mark, 92.8 feet east of tablet, on top of large boulder, at north end of foot-bridge over Anthony Creek; chiseled square..................................	2,342.42
Trainer P. O., 1.32 miles northeast of, 50 feet north of road, on south bank of Anthony Creek, 20 feet west of fence line, in south root of 10-inch sycamore tree; copper nail and washer, tree marked "U. S. B. M. 2,293.1"..........	2,293.54
Trainer P. O., 0.17 mile northeast of, on west edge of road, 100 feet south of **May Chapel**, in south root of forked oak tree; copper nail and washer, tree marked "U. S. B. M. 2,254.1"..	2,254.54
Trainer P. O., 0.64 mile southwest of, 35 feet north of road center, in front of home of G. H. Rucker, set in top of concrete post; bronze tablet stamped "W. Va. 1921 H 173 2217", fence-post marked "U. S. B. M. 2,217.1"....	2,217.436
Witness bench mark, 49 feet south 25° east of tablet, in north root of 20-inch Columbia poplar tree; copper nail and washer..	2,215.65
Trainer P. O., 1.48 miles southwest of, 30 feet west of road, 50 feet south of forks of lane, 100 feet north of ford, in east root of tall stump; copper nail and washer, tree marked "U. S. B. M. 2,188.4".........................	2,188.76
Trainer P. O., 2.11 miles southwest of, in southeast corner of road forks, 20 feet north of log railroad, in south root of 15-inch pine tree; copper nail and washer, tree marked "U. S. B. M. 2,178.4"................................	2,178.72
Trainer P. O., 2.93 miles southwest of, 1 mile northeast of **Columbia Sulphur Springs**, in southeast corner of cat-	

Feet.

tle-guard, in end of stringer between rails of lumber railroad; copper nail and washer, guard-rail marked "U. S. B. M. 2,146.3".. 2,146.64

Columbia Sulphur Springs, north of Anthony Creek and 40 feet east of center of road crossing creek, 1 foot west of fence line, in top of boulder in place; bronze tablet stamped "W. Va. 1921 H 12 2123"...................... 2,122.535

Witness bench mark, 36.4 feet south 80° west of tablet, in root of 12-inch pine tree, copper nail and washer...... 2,122.82

From Marlinton southeast along highways into Warm Springs Quadrangle.

Marlinton, 950 feet west of railroad station, 50 feet south of asphalt road, 60 feet east of concrete highway bridge over Greenbrier River, in top of concrete post; bronze tablet stamped "W. Va. 1921 H 160 2123"............... 2,122.574

Marlinton, 0.98 mile southeast of, on west edge of sharp turn in road, 5 feet east of corner fence-post, on top of large flat boulder; chiseled square, boulder marked "U. S. B. M. 2,213.4".. 2,213.69

Marlinton, 1.96 miles southeast of, on north edge of road, in east end of concrete culvert; chiseled square, culvert marked "U. S. B. M. 2,163.6"........................... 2,163.95

Marlinton, 2.74 miles southeast of, on north edge of road, in center of top of concrete culvert; chiseled square, culvert marked "U. S. B. M. 2,169.1"...................... 2,169.43

Marlinton, 3.60 miles southeast of, 2.92 miles west of **Huntersville,** on north edge of road, in top of concrete culvert; bronze tablet stamped "W. Va. 1921 H 175 2191", culvert marked "U. S. B. M. 2,190.4"................... 2,190.700

Witness bench mark, 233.8 feet north 70° east of tablet, in center of concrete culvert; chiseled square............ 2,190.60

Huntersville, 1.89 miles northwest of, on north edge of road, center of top of concrete culvert; chiseled square, culvert marked "U. S. B. M. 2,199.6"..................... 2,199.93

Huntersville, 1.08 miles northwest of, 40 feet north of road center, 50 feet northeast of ford, in south root of 12-inch oak tree, in fence line; copper nail and washer, tree marked "U. S. B. M. 2,206"............................ 2,206.30

Huntersville, about 600 feet east of post-office, 40 feet south by 40 feet east of crossroads, set in top of concrete post; bronze tablet stamped "W. Va. 1921 H. 176 2266", post marked "U. S. B. M. 2,266"....................... 2,266.369

Witness bench mark, 100.8 feet south 40° east of tablet, in west root of large stump; copper nail and washer..... 2,268.81

	Feet.
Huntersville, 0.81 mile southeast of, on north edge of road, 150 feet north of north end of highway bridge over Knapp Creek, on top of large boulder; chiseled square, telephone-pole marked "U. S. B. M. 2,257.8"...........	2,258.17

From Huntersville southwest along highways to near southwest corner of quadrangle.

Huntersville, in southeast corner of crossroads, in top of concrete post; bronze tablet stamped "W. Va. 1921 H 176 2266"..	2,266.369
Huntersville, 0.75 mile southwest of, on east edge of road, at gate to pasture, on top of steel culvert; chiseled square, post marked "U. S. B. M. 2,270.3".....................	2,270.58
Huntersville, 1.44 miles southwest of, on east edge of road, 70 feet south of ford and 60 feet north of gate, in west root of 12-inch pine tree; copper nail and washer, tree marked "U. S. B. M. 2,307".......................	2,307.34
Huntersville, 2.11 miles southwest of, on west edge of road, north side of drain, 130 feet north of house, in north root of 18-inch pine tree; copper nail and washer, tree marked "U. S. B. M. 2,383.7".........................	2,383.95
Huntersville, 3.38 miles southwest of, on east edge of road, opposite **Cummins Creek School,** set in top of concrete post; bronze tablet stamped "W. Va. 1921 H 194 2519", post marked "U. S. B. M. 2,518.6".....................	2,518.847
Witness bench mark, 38.2 feet south 30° west of tablet, in crotch of oak tree; copper nail and washer............	2,523.05
Huntersville, 4.44 miles southwest of, at forks of road, 40 feet north of, in south root of 20-inch oak tree; copper nail and washer, tree marked "U. S. B. M. 2,459.5"....	2,458.85
Huntersville, 5.12 miles southwest of, 30 feet west of road center, 30 feet north of run, just south of house, in east root of 10-inch pine tree; copper nail and washer, tree marked "U. S. B. M. 2,468.5".........................	2,468.90
Huntersville, 6.19 miles southwest of, 4.01 miles northeast of **Burr School,** on west edge of road, just south of road forks, in northeast corner of yard to home of W. M. Underwood, set in top of concrete post; bronze tablet stamped "W. Va. 1921 H 195 2405", post marked "U. S. B. M. 2,404.6"..	2,405.022
Witness bench mark, 69.3 feet south 40° west of tablet, in south root of 15-inch apple tree; copper nail and washer..	2,404.80
Burr School, 3.29 miles northeast of, 80 feet west of road, 250 feet southwest of **Beaver Creek School,** on south edge of lane west, in east root of 15-inch oak tree; copper nail and washer, tree marked "U. S. B. M. 2,427.1".........	2,427.62

	Feet.
Burr School, 2.45 miles northeast of, on west edge of sharp turn in road, in north root of 20-inch pine tree; copper nail and washer, tree marked "U. S. B. M. 2,480.7".....	2,481.15
Burr School, 2.03 miles northeast of, on west edge of forks of road, in east root of 40-inch oak tree; copper nail and washer, tree marked "U. S. B. M. 2,506"...............	2,506.40
Burr School, 1.18 miles northeast of, on east edge of road, in east root of tall stump; copper nail and washer, stump marked "U. S. B. M. 2,595.7".........................	2,595.94
Burr School, 0.58 mile northeast of, 30 feet north of road center, in gap, set in top of concrete post; bronze tablet stamped "W. Va. 1921 H 196 2744", stump marked "U. S. B. M. 2,744.2".....................................	2,744.509
Witness bench mark, 24.7 feet north 10° west of tablet, in east root of stump; copper nail and washer............	2,742.62
Burr School, 150 feet south of, on south edge of forks of road, in west root of 30-inch oak tree; copper nail and washer, tree marked "U. S. B. M. 2,602.5".............	2,602.84
Burr School, 0.78 mile southwest of, 50 feet south of road, on west bank of run, in top of large stump; copper nail and washer, stump marked "U. S. B. M. 2,543.8".......	2,544.15
Burr School, 1.44 miles southwest of, on east edge of road, 150 feet south of ford, 200 feet north of another ford, in top of large stump; copper nail and washer, stump marked "U. S. B. M. 2,474.2".........................	2,474.52
Burr School, 2.32 miles southwest of, 30 feet east of road center, 50 feet north of run, set in top of concrete post; bronze tablet stamped "W. Va. 1921 H 197 2471", tree marked "U. S. B. M. 2,470.9".....................	2,471.250
Witness bench mark, 62.8 feet north 5° west of tablet, in west root of large stump; copper nail and washer.....	2,469.69
Burr School, 3.44 miles southwest of, on south edge of road, in gap, in north root of 15-inch oak tree; copper nail and washer, tree marked "U. S. B. M. 2,645.1".............	2,645.30
Burr School, 4.46 miles southwest of, 30 feet south of road center, 20 feet west of run, in west root of tall stump; copper nail and washer, stump marked "U. S. B. M. 2,445.9"...	2,446.25

From Seebert northwest along highways toward Lobelia.

Seebert, 0.66 mile northwest of, on west edge of sharp turn in road, on top of stone coping of culvert; chiseled square, shed marked "U. S. B. M. 2,169.5"..............	2,169.53
Seebert, 1.33 miles northwest of, 60 feet west of road, on south edge of road to southwest, in east root of 12-inch	

Feet.

oak tree; copper nail and washer, tree marked "U. S. B. M. 2,362.7" 2,362.92

Seebert, 2.01 miles northwest of, 1.26 miles east of **Hillsboro**, 60 feet north of **Pleasant Grove School**, at ╤-road south, 40 feet east by 150 feet south of, on top of sandstone boulder; chiseled square, telephone-pole marked "U. S. B. M. 2,287.7" 2,287.95

Hillsboro, in northwest quadrant of crossroads, in concrete walk at front step of church; tablet stamped "2302" 2,302.408

Witness bench mark, 45.1 feet south 80° west, in south root of 15-inch maple tree 2,299.78

Hillsboro, 0.93 mile northwest of, on east edge of road, 350 feet north of dwelling, at angle in road, on north edge of farm road, east through gate, in south root of 24-inch oak tree; copper nail and washer, tree marked "U. S. B. M. 2,330.4" 2,330.46

Hillsboro, 2.08 miles west of, 40 feet west of road center, on north edge of private lane west through gate, on top of boulder; chiseled square, rock marked "U. S. B. M. 2,537.4" 2,537.34

From Marlinton north along highways into Mingo Quadrangle. (Part of an unadjusted line closing 1.2 feet high).

Marlinton, 950 feet west of railroad, 50 feet south of concrete road, 60 feet east of east end of concrete highway bridge over Greenbrier River, in top of concrete post; bronze tablet stamped "W. Va. 1921 H 160" 2,122.574

Marlinton, 0.89 mile northwest of, on east edge of road, 50 feet south of second-class ╤-road east, in center of top of concrete culvert; chiseled square, marked "U. S. B. M. 2,131" 2,131.29

Marlinton, 1.89 miles northwest of, 0.4 mile north of **Campbelltown**, on east edge of road, just south of angle in road, on top face of ledge of rock; chiseled square; rock marked "U. S. B. M. 2,358.8" 2,359.01

MINGO QUADRANGLE: POCAHONTAS, RANDOLPH, AND WEBSTER COUNTIES.

(Latitude 88° 15′-38° 30′; Longitude 80° 00′-80° 15′).

Primary leveling by E. E. Harris in 1921 and P. E. Davenport in 1922:

From near Marlinton, Marlinton Quadrangle, north along highways to near Slaty Fork Post-Office. Part of an unadjusted line closing 0.948 feet high.

(This line was releveled in 1923, partly by H. R. Kilmer and partly by R. C. Seitz, without finding error. Additional lev-

Feet.

eling should be done to reduce errors in the two circuits of Mingo Quadrangle of nearly 1 foot each).

Marlinton, 2.87 miles north of, on west edge of road, on north edge of a dim road to southwest, 10 feet west of corner fence-post, in south root of large stump; copper nail and washer, fence-post marked "U. S. B. M. 2,500.8"......... 2,501.06

Marlinton, 3.46 miles north of, 0.62 mile south of **Edray,** 4.33 miles east of **Woodrow,** at forks of ╥-road west, 40 feet west by 60 feet south of, 15 feet south of small store, in yard of L. J. Moore, set in top of concrete post; bronze tablet stamped "W. Va. 1921 H 177", telephone-pole marked "U. S. B. M. 2,501.5"......................... 2,501.795

Reference bench mark, 43.6 feet south 40° west of tablet, in east root of 8-inch locust tree; copper nail and washer.. 2,502.73

Edray, 400 feet south of post-office, in forks of Y-road, in center of top of concrete culvert; chiseled square, culvert marked "U. S. B. M. 2,409.2"...................... 2,409.49

Edray, 1.01 miles north of, on north edge of road, in south root of 30-inch chestnut tree; copper nail and washer, tree marked "U. S. B. M. 2,706.5"....................... 2,706.76

Edray, 1.82 miles north of, 30 feet east of road center, 10 feet east of wire fence line, 50 feet south of rail fence line, on side of cleared hill, in top of rock set in place; bronze tablet stamped "W. Va. 1921 H 178", telephone-pole marked "U. S. B. M. 3,026.6" (not found, 1923)........ 3,026.742

Reference mark, 35.4 feet west of tablet, on top of ledge of rock; chiseled square (not found, 1923)............... 3,028.54

Edray, 2.99 miles north of, in gap of **Red Lick Mountain,** 40 feet west of center and 50 feet south of cross lane, in east root of 24-inch oak tree; copper nail and washer, tree marked "U. S. B. M. 3,539.4"....................... 3,539.42

Edray, 4.02 miles north of, 0.54 mile south of **Crooked Fork School,** 40 feet west of road center, at southeast corner of private garage, in north root of 15-inch oak tree; copper nail and washer, tree marked "U. S. B. M. 3,166.3".. 3,166.46

Edray, 5.04 miles south of, 0.48 mile north of **Crooked Fork School,** 40 feet west of sharp turn in road, in top of large sandstone boulder; bronze tablet stamped "W. Va. 1921 H 179".. 3,064.333

Reference mark, 95 feet north 25° east of tablet, on top of pointed boulder; chiseled square...................... 3,061.26

Edray, 6.01 miles north of, on east edge of angle in road, 40 feet south of gate, on east edge of long outcrop of rock; chiseled square, boulder marked "U. S. B. M. 3,014.8"... 3,015.10

Edray, 6.68 miles north of, 850 feet south of **New Pleasant**

Feet.

Valley School, on west edge of road, in line with ╥-road east, on top of boulder; chiseled square, fence-post marked "U. S. B. M. 2,957.7" 2,958.12

Edray, 7.64 miles north of, 40 feet north of road center, 55 feet east of **Marys Chapel**, 2 feet west of fence line, in top of large sandstone boulder; bronze tablet stamped "W. Va. 1921 H 180", fence marked "U. S. B. M. 2,949.9" .. 2,950.309

Reference mark, 41.6 feet north 40° west of tablet, on top of sandstone boulder; chiseled square 2,950.99

Edray, 8.53 miles north of, 0.88 mile northwest of **Marys Chapel**, 0.46 mile south of **Hannah School**, on east edge of road, at foot of hill and on south side of drain, in west root of 24-inch oak tree; copper nail and washer, tree marked "U. S. B. M. 2,909.8" 2,910.18

Edray, 9.60 miles north of, 0.61 mile northwest of **Hannah School**, on west edge of road, 130 feet north of run crossing road, on east side of gate, on top of boulder; chiseled square, fence marked "U. S. B. M. 2,858.3" 2,858.79

Edray, 10.73 miles north of, 80 feet north of road, 40 feet south of crest of hill, overlooking Old Field Fork, 4 feet east of lone tree, in top of large sandstone boulder; bronze tablet stamped "W. Va. 1921 H 181", telephone-pole marked "U. S. B. M. 2,818.2" 2,818.489

Reference mark, 52.4 feet north 40° east of tablet, on top of sandstone boulder; chiseled square 2,820.09

Edray, 11.32 miles north of, 0.80 mile south of Luther D. Sharp's store, on west edge of road, on top of boulder; chiseled square, boulder marked "U. S. B. M. 2,787.1" ... 2,787.46

Edray, 12.10 miles north of, 240 feet south of Luther D. Sharp's store, in center of east concrete parapet wall to bridge over Slaty Fork; chiseled square, wall marked "U. S. B. M. 2,809.2" 2,809.53

Slaty Fork P. O., 1.29 miles east of, 4.01 miles west of **Linwood**, 0.50 mile north of Luther D. Sharp's store, on south edge of road, 60 feet west of roads forks, in top face of long ledge of rock; bronze tablet stamped "W. Va 1921 H 182", rock ledge marked "U. S. B. M. 2,799.5". (Unadjusted) 2,799.852
(Adjusted elevation) 2,798.908

From near Slaty Fork P. O., north along highways into Pickens Quadrangle.

Primary leveling by E. E. Harris in 1921 and P. E. Davenport in 1922:

(An excessive adjustment has been made in this line).

Slaty Fork P. O., 1.29 miles east of, 4.01 miles west of **Linwood**, 0.50 mile north of Luther D. Sharp's store, on

	Feet.
south edge of road, 60 feet west of road forks, in top face of long ledge of rock; bronze tablet stamped "W. Va. 1921 H 182", rock ledge marked "U. S. B. M. 2,799.5"	2,798.908
Reference mark, 45.4 feet north 70° east of tablet, on rock ledge; chiseled square	2,795.96
Slaty Fork P. O., 200 feet south of, on east edge of road, in west root of 30-inch oak tree; copper nail and washer, tree marked "U. S. B. M. 2,671.3"	2,670.68
Slaty Fork P. O., 1.28 miles north of, 1,970 feet north of mile-post C 23. 20 feet east of track, at base of rock cliff, at south end of big cut, on top of face of ledge of rock; chiseled square, rock marked "U. S. 2,623.2 B. M."	2,622.36
Slaty Fork P. O., 2.35 miles north of, 2,400 feet north of mile-post C 24, 35 feet west of track, 100 feet north of shanty, in top of boulder below track; bronze tablet stamped "W. Va. 1921 H 183", boulder marked "U. S. B. M. 2,577.3"	2,576.444
Reference mark, 49.5 feet north 20° west of tablet, on top of boulder; chiseled square	2,580.30
Slaty Fork P. O., 3.33 miles north of, 2,240 feet north of mile-post C 25, 10 feet west of track, on top of pointed boulder; chiseled square, boulder marked "U. S. B. M. 2,547.5"	2,546.51
Slaty Fork, P. O., 4.37 miles north of, 1,260 feet south of Blackhole Run, 2,900 feet north of railroad trestle over Elk River, 20 feet east of track, on top of boulder; chiseled square, boulder marked "U. S. B. M. 2,523.4"	2,522.35
Slaty Fork P. O., 5.33 miles north of, 48 feet east of track, 80 feet northeast of gate to farmhouse of Hanson Hamrick, in west end of large boulder, in open field; bronze tablet stamped "W. Va. 1921 H 184", telegraph-pole marked "U. S. B. M. 2,488.3"	2,487.150
Reference mark, 81.0 feet north 20° west of tablet, on top of boulder; chiseled square	2,485.44
Slaty Fork P. O., 6.27 miles north of, 2,060 feet north of mile-post C 28, 900 feet north of shanty and warehouse, 10 feet east of track, on top of large boulder; chiseled square, boulder marked "U. S. B. M. 2,453.4"	2,452.27
Slaty Fork P. O., 7.37 miles north of, 40 feet east of track, 430 feet north of railroad switch, in top of large sandstone boulder; bronze tablet stamped "W. Va. 1921 H 185", boulder marked "U. S. B. M. 2,391.6"	2,390.422
Reference mark, 116.8 feet north 40° west of tablet, on top of boulder; chiseled square	2,389.68

Feet.

From Edray west along highways to Williams River. (Double spur line based upon unadjusted line north from Marlinton).

Woodrow, 3.50 miles east of, on south edge of road, 60 feet east of road forks, at **Onoto**, in center of parapet wall of new concrete bridge over Dry Creek; chiseled square, wall of bridge marked "U. S. B. M. 2,351".............. 2,351.38

Woodrow, 2.80 miles east of, 40 feet west of road center, on north edge of second-class road west, 100 feet south of **Pine Grove School**, in south root of 20-inch oak tree; copper nail and washer, tree marked "U. S. B. M. 2,500".. 2,500.30

Woodrow, 1.88 miles east of, on south edge of road, just east of angle in road, at foot of hill, on top of large boulder; chiseled square, boulder marked "U. S. B. M. 2,520.7"... 2,520.98

Woodrow, 1.88 miles east of, 40 feet south of road center, 150 feet east of gate, in top of boulder; bronze tablet stamped "W. Va. 1921 H 191", telephone-pole marked "U. S. B. M. 2,520.3".................................. 2,520.522

Reference mark, 47 feet north 75° west of tablet, on top of boulder; chiseled square.............................. 2,521.88

Woodrow, 1.08 miles southeast of, 0.34 mile west of **West Union Church**, north edge of road, on top of rock, at base of cliffs; chiseled square, rock marked "U. S. B. M. 2,800"... 2,800.13

Woodrow, 0.48 mile southeast of, in southwest corner of forks of lane, on top of boulder; chiseled square, telephone-pole marked "U. S. B. M. 2,992.1"............... 2,992.06

Woodrow, center of road in front of post-office, "3,202" marked on rock.................................... 3,202.

Reference mark, 186 feet south and 20 feet west of tablet, on east edge of road, on top of large flat boulder; chiseled square... 3,204.87

Woodrow, 430 feet north of post-office, 300 feet southeast of forks of road, 80 feet east of road center, in top of large boulder; bronze tablet stamped "W. Va. 1921 H 192", telephone-pole marked "U. S. B. M. 3,209.7"............ 3,209.536

Woodrow, 0.67 mile northwest of, 30 feet north of road center, 50 feet east of church, in south root of 15-inch oak tree; copper nail and washer, tree marked "U. S. B. M. 3,215.9"... 3,215.76

Woodrow, 1.35 miles northwest of, on west edge of road, 70 feet south of gate across road, in east root of 8-inch poplar tree; copper nail and washer, tree marked "U. S. B. M. 3,215.5"....................................... 3,215.43

Woodrow, 2.32 miles northwest of, on east edge of road, 300 feet south of run crossing road, on top of large boulder;

	Feet.
chiseled square, boulder marked "U. S. B. M. 3,171".....	3,170.99
Woodrow, 2.89 miles northwest of, 20 feet east of road center, 30 feet north of run crossing road, in top of large boulder; bronze tablet stamped "W. Va. 1921 H 193", tree marked "U. S. B. M. 3,118.5"......................	3,118.536
Reference mark, 45.7 feet north of tablet, in west root of 6-inch oak tree; copper nail and washer...............	3,120.97
Woodrow, 3.71 miles northwest of, 60 feet south of road center, at point where road drops off to Williams River, top of cleared hill, in north root of 6-inch cherry tree; copper nail and washer, tree marked "U. S. B. M. 3,178.7"...	3,178.75

From near Slaty Fork P. O. along highways east and north into Pickens Quadrangle.

Edray, 12.60 miles north of, 1.29 miles east of **Slaty Fork P. O.**, 4.01 miles west of **Linwood**, on south edge of road, 60 feet west of road forks, in top of long ledge of rock; bronze tablet stamped "W. Va. 1921 H 182", rock ledge marked "U. S. B. M. 2,799.5".........................	2,798.908
Reference mark, 45.5 feet north 70° east of tablet, on rock ledge; chiseled square................................	2,795.96
Linwood, 3.07 miles west of, on south edge of road, 30 feet east of run and about 80 feet northwest of house on hillside, on top of ledge of rock; chiseled square, post marked "U. S. T. B. M. 2,868.8"......................	2,868.18
Linwood, 2.31 miles west of, on north edge of road, 15 feet east of gate and 150 feet west of lane to house, in south root of 25-inch oak tree; copper nail and washer, tree marked "U. S. B. M. 2,819.5".........................	2,818.86
Linwood, 1.65 miles west of, on south side of road, at base of east end of parapet wall of new concrete bridge over Big Spring Fork; chiseled square, wall marked "U. S. B. M. 2,846.9"...	2,846.28
Linwood, 0.85 mile west of, on north edge of road, on top of rock ledge; chiseled square, telephone-pole marked "U. S. B. M. 2,896.7".......................................	2,896.07
Linwood, 500 feet west of post-office, 250 feet west of ╗╔-road south, on north edge of angle in road, in top face of ledge of rock; bronze tablet stamped "W. Va. 1921 H 198", shed marked "U. S. B. M. 2,943.1"...............	2,942.397
Reference mark, 68.8 feet south 75° east of tablet, on top of boulder; chiseled square..............................	2,940.43
Linwood, 1.17 miles north of, on west edge of sharp turn in road, on top of large flat boulder, on north edge of run; chiseled square, boulder marked "U. S. B. M. 3,242".....	3,241.24

	Feet.
Linwood, 1.87 miles north of, in gap of **Middle Mountain**, in southwest corner of crossing of Western Maryland Railroad and county road, in east root of 18-inch oak tree; copper nail and washer, telephone-pole marked "U. S. B. M. 3,501.8"	3,501.03
Linwood, 2.79 miles north of, 10 feet south of track, 20 feet east of water-tank, on top of large boulder; chiseled square, boulder marked "U. S. B. M. 3,581.4"	3,580.61
Linwood, 3.59 miles north of, 3.55 mlies south of **Mingo**, at **Mace**, 200 feet north of lane to, on west edge of road, in top face of rock ledge; bronze tablet stamped "W. Va. 1921 H 199", telephone-pole marked "U. S. B. M. 3,464.4"	3,463.582
Reference mark, 58 feet north 10° west of tablet, on top of rock ledge; chiseled square	3,460.25
Mingo, 2.51 miles southeast of, on east edge of road, at southwest corner of old **Fairview School** (now abandoned), in west root of forked oak tree; copper nail and washer, telephone-pole marked "U. S. B. M. 3,102.4"	3,101.85
Mingo, 1.74 miles south of, on south edge of sharp turn in road, 300 feet south of new **Fairview School**, on west edge of private lane and 60 feet east of second-class road, on top of rock ledge; chiseled square, rock marked "U. S. B. M. 2,993"	2,992.48
Mingo, 0.87 mile south of, on east edge of road, top of rise, in top face of concrete foundation of iron gate to fence around memorial monument; chiseled square, telephone-pole marked "U. S. B. M. 3,037.2"	3,036.72
Mingo, 0.51 mile south of post-office, 50 west of road, 50 feet north of old church (now abandoned) at **Upper Mingo**, in top of large boulder; bronze tablet stamped "W. Va. 1921 H 200", rock marked "U. S. B. M. 2,691.7"	2,691.396
Reference mark, 38.2 feet north 85° east of tablet, in west root of 18-inch oak tree; copper nail and washer	2,689.34
Mingo, at south end of steps at entrance to post-office, on top of large flat boulder; chiseled square, telephone-pole marked "U. S. B. M. 2,638.8"	2,638.54
Mingo, 1.06 miles northwest of, 3.5 miles southeast of **Monterville**, 40 feet west of road, 150 feet north of barn, (in Pickens Quadrangle), in south root of 10-inch apple tree; copper nail and washer, tree marked "U. S. B. M. 2,961.1"	2,960.80

From Linwood southeast along highways to near Clover Lick, Cass Quadrangle.

Primary leveling by P. E. Davenport in 1922:

Linwood, 500 feet west of post-office, 250 feet west of ╗╔-road south, on north edge of angle in road, in top face of

	Feet.
ledge of rock; bronze tablet stamped "W. Va. 1921 H 196", shed marked "U. S. B. M. 2,943.1"	2,942.397
Linwood, 1.1 miles southeast of, in limestone rock, on south margin of road; rock painted "U. S. 3,036.3", chiseled square	3,035.33
Wooddell mail-box, center of road	3,110.0
Linwood, at creek, 1.8 miles east of	3,091.9
Linwood, 2.09 miles southeast of, in large limestone rock, on side of road; chiseled square, rock painted "U. S. B. M. 3,111.2"	3,110.16
Yewglade School, in front of; ground	3,125.5
Linwood, 2.8 miles southeast of, in small rock, on east side of road, north of rock; chiseled square, painted "U. S. B. M. 3,322.8"	3,321.87
Linwood, 3.27 miles southeast, of, 7 feet north of north gate-post, 25 feet west of center of road, in pasture of O. A. Bell, on point of **Cloverlick Mountain**, on concrete post; bronze tablet stamped "W. Va. D 1", mail-box painted "U. S. B. M. 3,502.5"	3,501.458
Reference mark, in stump of locust tree, on west side of road, 38 feet southeast of post; copper nail and washer	3,499.14
Stone, west side of road, painted "3,326"	3,325.4
Linwood, 4.15 miles southeast of, 1.4 miles east of **Gibson Knob**, in sandstone rock, on east edge of road; chiseled square, painted "U. S. B. M. 3,078.5"	3,077.57
Linwood, 6.04 miles southeast of, 4.25 miles northwest of **Clover Lick**, in old gate-post, on west side of road; copper nail and washer, gate painted "U. S. B. M. 2,611.6"	2,610.78
Sharp curve in road, pole, painted "2,526"	2,524.8
Linwood, 6.13 miles southeast of, 4.15 miles northwest of **Clover Lick**, on small sandstone rock, on west side of road, at cattle-scale side of shed, painted "U. S. B. M. 2,513.1", chiseled square	2,512.25
Clover Lick, 3.36 miles northwest of, 45 feet south 30° east of center of road, 47 feet west of 24-inch oak tree on north bank of Cloverlick Creek, in flint rock; bronze tablet stamped "W. Va. D", elevation painted on large rock on north side of road "U. S. B. M. 2,408.9"	2,408.078
Reference mark, in north root of 24-inch oak tree, 47 feet east of tablet, 25 feet north of Cloverlick Creek, 200 feet west of gate in fence corner; copper nail and washer	2,408.70

	Feet.
At old abandoned schoolhouse, elevation painted "2,389"....	2,388.8

Primary leveling by E. E. Harris in 1921:

From Cass Quadrangle southwest along Chesapeake and Ohio Railroad across southeast corner of quadrangle into Marlinton Quadrangle.

Big Run, 0.76 mile southwest of, 20 feet south of mile-post W 66, east side of track, in top of rack for extra rail; copper nail and washer, telegraph-pole marked "U. S. B. M. 2,237.4"........	2,237.64
Big Run, 1.75 miles southwest of, 0.44 mile northeast of **Harter,** 20 feet east of mile-post W 65, 10 feet south of track, in top of rack for extra rail; copper nail with washer (rock marked), base of mile-post marked "U. S. B. M. 2,221.2"........	2,221.50
Harter, in front of station-sign; top of near rail, end of tie marked "U. S. 2,210.3"........	2,210.6
Harter, 1,740 feet southwest of station, 1,200 feet north of mile-post W 64, 15 feet east of track, on top face of ledge of rock; bronze tablet stamped "W. Va. 1921 H 157", rock marked "U. S. B. M. 2,205.6"........	2,205.845
Reference mark, 56.3 feet south 15° east of tablet, on top of boulder; chiseled square........	2,205.85
Harter, 1.25 miles southwest of, 0.90 mile east of **Clawson,** 1,620 feet north of mile-post W 63, 10 feet east of track, at base of leaning boulder; chiseled square, boulder marked "U. S. B. M. 2,196.2"........	2,196.49
Clawson, in front of station-sign; top of rail, end of tie marked "U. S. B. M. 2,185.3"........	2,185.6
Clawson, 70 feet south of station-sign, 60 feet west of track, in east root of pear tree; copper nail with washer, tree marked "U. S. B. M. 2,182.3"........	2,182.58
Thorny Creek, in front of station-sign; top of near rail; end of tie marked "U. S. 2,174.4"........	2,174.6
Thorny Creek, 500 feet south of station, 0.95 mile northeast of **August,** 1,000 feet north of mile-post W 61, 40 feet west of track, in top of boulder below track; bronze tablet stamped "W. Va. 1921 H 158", rock marked "U. S. B. M. 2,166.4"........	2,166.683
Reference mark, 81 feet south 40° west of tablet, in east root of 6-inch maple tree; copper nail and washer........	2,167.58

SPRUCE KNOB QUADRANGLE: PENDLETON, RANDOLPH, AND POCAHONTAS COUNTIES.

(Latitude 38° 30′-38° 45′; Longitude 79° 30′-79° 45′).

Primary leveling by E. E. Harris in 1921:

From Circleville, Circleville Quadrangle, along highways southwest and south to Dry Run P. O., thence southeast into Circleville Quadrangle.

	Feet.
Circleville, 0.97 mile south of, 30 feet west of road, on south side of drain, on top of large boulder; chiseled square, fence marked "U. S. B. M. 2,095.3"	2,095.31
Circleville, 1.71 miles south of, in northeast corner of sharp turn in road, 20 feet east of run, on top of boulder; chiseled square, fence marked "2,158.7"	2,157.71
Circleville, 2.59 miles south of, on west edge of road, on south edge of lane through gate, on top of boulder; chiseled square, gate-post marked "U. S. B. M. 2,160.5"	2,160.45
Circleville, 3.19 miles south of, at **Big Run,** in **Big Run Church yard,** 30 feet west of road, 86 feet east of northeast corner of church, in top of large boulder; bronze tablet stamped "W. Va. 1921 H 69 2206", fence marked U. S. B. M. 2,206.4"	2,206.327
Witness bench mark, S. 75° W. of tablet, on top of outcrop of rock; chiseled square	2,206.66
Circleville, 3.83 miles south of, on east edge of road, 250 feet north of foot-bridge, in south end of triangle formed by forks of lane east to farmhouse, on top of boulder; chiseled square, fence marked "U. S. B. M. 2,216.5"	2,216.48
Circleville, 4.56 miles south of, 1.10 miles northwest of **Dry Run Post-Office,** on north edge of ┬-road east, 50 feet east of north-and-south road, in west root of 30-inch walnut tree; copper nail and washer, tree marked "U. S. B. M. 2,252.1"	2,252.05
Dry Run Post-Office, about 500 feet west of, on north edge of road, east edge of run, west edge of lane north through gate, on top of large boulder; chiseled square, fence marked "U. S. B. M. 2,379.6"	2,379.55
Dry Run P. O., 0.88 mile southeast of, 40 feet east of road, 50 feet north of second-class road east, in top of boulder; bronze tablet stamped "W. Va. 1921 H 70 2492", fence-post marked "U. S. B. M. 2,491.7"	2,491.619
Witness bench mark, 16.7 feet south 10° east of tablet, on top of boulder; chiseled square	2,492.16
Dry Run P. O., 1.77 miles southeast of, on north edge of road, west of bridge over Dry Run, on top of boulder; chiseled square, fence marked "U. S. B. M. 2,625.3"	2,625.25
Dry Run P. O., 2.49 miles southeast of, in forks of road at Weimer's blacksmith shop, on top of small outcrop of	

	Feet.
rock; chiseled square, telephone-pole marked "U. S. B. M. 2,800.8"	2,800.81
Dry Run P. O., 3.15 miles southeast of, 30 feet west of road center, in line with lane east through gate to farmhouse, in top of concrete post; bronze tablet stamped "W. Va. 1921 H 81 3142", fence-post marked "U. S. B. M. 3,141.7"	3,141.532
Witness bench mark, 37.8 feet west of tablet, in north root of 30-inch apple tree; copper nail and washer	3,140.95
Dry Run P. O., 3.69 miles southeast of, on east edge of road, in gap, in top of stump of telephone-pole; copper nail and washer, fence marked "U. S. B. M. 3,401.7"	3,401.54
Dry Run P. O., 4.51 miles southeast of, on east edge of road, in bed of run, on top of ledge of rock; chiseled square, ledge marked "U. S. B. M. 3,076.7"	3,076.50
Cave P. O., 2.26 miles southwest thence 2.78 miles northwest of, at forks of road southeast to Crabbottom, 50 feet east of road center, in top of large boulder; bronze tablet stamped "W. Va. 1921 H 80 2834", gate-post marked "U. S. B. M. 2,834.2"	2,834.108
Witness bench mark, 37.3 feet west of tablet, in east root of 15-inch walnut tree; copper nail and washer	2,834.61

From Horton Quadrangle along highways southwest to Osceola, thence northwest into Horton Quadrangle.

Horton, 7.19 miles south of, at north end of railroad trestle, in top face of sill between tracks; copper nail and washer, guard-rail marked "U. S. B. M. 3,225.3"	3,225.55
Horton, 8.22 miles south of, on east side of track, near south end of fenced-in field, on top of boulder; chiseled square, fence marked "U. S. B. M. 3,284.3"	3,284.52
Horton, 8.96 miles south of, 15 feet south of track, 350 feet east of switch, in sharp turn in railroad, on top of large flat boulder; chiseled square, telegraph-pole marked S. S. B. M. 3,330.7"	3,330.90
Witness bench mark, 33 feet north 10° west of tablet, on top of boulder; chiseled square	3,427.40
Horton, 9.70 miles south of, 1.62 miles northeast of **Osceola**, 15 feet east of track, in top of large sandstone boulder; bronze tablet stamped "W. Va. 1921 H 102 3430", boulder marked "U. S. B. M. 3,430"	3,430.263
Osceola, 0.68 mile northeast of, 30 feet west of road, north side of wire fence, just west of gate, on top of boulder; chiseled square, telephone-pole marked "U. S. B. M. 3,488.3"	3,488.48

Feet.

Osceola, 200 feet west of post-office (post-office has since been moved 1.2 miles west of Osceola and 0.6 mile southwest of Osceola School), 100 feet west of ╥-road north, 40 feet north of center of road, in south root of 7-inch elm tree; copper nail and washer, tree marked "U. S. B. M. 3,513.1" 3,513.29

Osceola, 1.35 miles northwest of, 500 feet northwest of **Osceola School,** 50 feet east of center of road, on north side of low gap, in center of flat boulder; bronze tablet stamped "W. Va. 1921 H 103 3595", fence-post marked "U. S. B. M. 3,594.8" 3,595.091

Witness bench mark, 33.6 feet south 75° west of tablet, inside fence line, on top of boulder; chiseled square... 3,594.19

Osceola, 2.10 miles northwest of, 60 feet north of road, 120 feet west of gate to farmhouse, on top of large boulder; chiseled square, boulder marked "U. S. B. M. 3,321.4".. 3,321.64

Osceola, 3.20 miles northwest of, on north edge of road, on roadbed, 10 feet east of southeast corner of shanty, on top of boulder; chiseled square, corner of shanty marked "U. S. B. M. 3,171.4" 3,171.62

Osceola, 3.81 miles northwest of, on north edge of road, in east edge of lane north through gate, on top of small boulder; chiseled square, telephone-pole marked "U. S. B. M. 3,138.4" 3,138.66

Osceola, 4.84 miles northwest of, 80 feet west of Laurel Fork, 55 feet south of sharp turn in road at foot of mountain, 35 feet west of old log road, in top of boulder set in place; bronze tablet stamped "W. Va. 1921 H 104 3102" post marked "U. S. B. M. 3,101.4" 3,101.625

Witness bench mark, 10.7 feet north 20° east of tablet, in top of small boulder; chiseled square 3,101.29

Osceola, 5.60 miles northwest of, on east edge of road, in west root of 12-inch elm tree; copper nail and washer, tree marked "U. S. B. M. 3,385.4" 3,385.65

From near Bartow, Durbin Quadrangle, northeast along highways to point west of Osceola.

Thornwood P. O. (Winterburn Station), 0.57 mile southwest of, west side of track, 25 feet south of second-class road crossing, top of rock ledge; chiseled square, rock marked "U. S. B. M. 2,842.9" 2,843.13

Thornwood P. O. (Winterburn Station), 900 feet west of station, 40 feet north of track, at angle in county road, east side of, in top of rock set in place; bronze tablet stamped "W. Va. 1921 H 123 2871", fence-post marked "U. S. B. M. 2,870.9" 2,871.179

	Feet.
Witness bench mark, 50.7 feet north of tablet, in top of rock, at south end of plank walk; chiseled square............	2,873.80
Thornwood P. O. (Winterburn Station), 0.87 mile northeast of, on south edge of road, 20 feet east of gate to pasture, on top of boulder; chiseled square, gate-post marked "U. S. B. M. 2,908.7"................................	2,908.99
Thornwood P. O. (Winterburn Station), 1.70 miles north of, 30 feet west of road, in north root of 20-inch spruce tree; copper nail and washer, tree marked "U. S. B. M. 3,147.7"...	3,147.88
Thornwood P. O. (Winterburn Station), 2.64 miles north of, on east edge of road, in west root of 10-inch oak tree; copper nail and washer, tree marked "U. S. B. M. 3,671"	3,671.04
Thornwood P. O. (Winterburn Station), 3.24 miles north of, in forks of Y-road, on top of **Burner Mountain**, set in top of concrete post; bronze tablet stamped "W. Va. 1921 H 124 4094", tree marked "U. S. B. M. 4,094.1"....	4,094.012
Witness bench mark, 68 feet north 30° east of tablet, in south root of 18-inch elm tree; copper nail and washer......	4,100.27
Thornwood P. O. (Winterburn Station), 4.07 miles north of, on north edge of road, on hill in road, in south root of 12-inch maple tree; copper nail and washer, tree marked "U. S. B. M." 4,076.5"................................	4,076.50
Thornwood P. O. (Winterburn Station), 4.78 miles north of, east edge of road, 200 feet south of corner fence-post, in west root of 12-inch tree; copper nail and washer, tree marked "U. S. B. M. 3,994.6"...........................	3,994.67
Thornwood P. O. (Winterburn Station), 5.67 miles north of, 80 feet south of road center, in north root of forked chestnut tree; copper nail and washer, tree blazed and marked "U. S. B. M. 3,912.5".........................	3,912.62
Thornwood P. O. (Winterburn Station), 6.16 miles north of, 30 feet east of road center, on top of high cleared knob, in top of concrete post; bronze tablet stamped "W. Va. 1921 H 125 3914", tree marked "U. S. B. M. 3,914.3"....	3,914.424
Witness bench mark, 49 feet north 40° west of tablet, in east root of 15-inch maple tree; copper nail and washer.....	3,914.24
Thornwood P. O. (Winterburn Station), 7.40 miles north of, 20 feet east of road center, 20 feet south of gate, in fence line, in west root of 20-inch oak tree; copper nail and washer, tree marked "U. S. B. M. 3,827.9"..........	3,828.11
Thornwood P. O. (Winterburn Station), 8.21 miles north of, 20 feet east of road center, at south edge of big clearing, on top of boulder; chiseled square, boulder marked "U. S. B. M. 3,729.7"................................	3,729.91

	Feet.
Thornwood P. O. (Winterburn Station), 8.76 miles north of, 0.84 mile west and 5.98 miles southwest of **Osceola**, 50 feet south of road center, 80 feet north of wire fence line, 40 feet east of rail fence line, 456 feet east of sheep shed, in top of concrete post; bronze tablet stamped "W. Va. 1921 H 126 3739", fence marked "U. S. B. M. 3,738.5"	3,738.763
Witness bench mark, 95.3 feet south 15° west of tablet, in east root of locust tree; copper nail and washer	3,738.78
Osceola, 0.84 mile west by 5.26 miles south of, in center of trail, in line with trail east through gate, 150 feet north of scales, on top of large boulder; chiseled square, fence marked "U. S. B. M. 3,811.3"	3,811.56
Osceola, 0.84 mile west by 4.28 miles south of, on east edge of road, in sharp turn in road, 0.23 mile northwest of **Stark School**, on top of large boulder, south of run crossing road; chiseled square, boulder marked "U. S. B. M. 3,677.9"	3,678.17
Osceola, 0.84 mile west by 3.48 miles south of, 50 feet southeast of road forks, 600 feet northeast of C. Lance's dwelling, 10 feet west of fence line, set in top of concrete post; bronze tablet stamped "W. Va. 1921 H 127 3637", gate-post marked "U. S. B. M. 3,636.5"	3,636.823
Witness bench mark, 83.5 feet west of tablet, on top of large boulder; chiseled square	3,633.03
Osceola, 0.84 mile west by 2.72 miles south of, 30 feet north of road, 20 feet south of wire fence line, 50 feet west of gate, on top of large boulder; chiseled square, boulder marked "U. S. B. M. 3,707.6"	3,707.85
Osceola, 0.84 mile west by 1.85 miles south of, on south edge of road, 40 feet east of gate, in angle of road, on top of boulder; chiseled square, boulder marked "U. S. B. M. 3,651.7"	3,651.97
Osceola, 0.84 mile west by 0.90 mile south of, on west edge of road, in north root of 30-inch maple tree; copper nail and washer, tree marked "U. S. B. M. 3,533.5"	3,533.85
Osceola, 1.35 miles northwest of, 500 feet northwest of **Osceola School**, 50 feet east of road center, north side of low gap, in top of flat boulder; bronze tablet stamped "W. Va. 1921 H 103 3595"	3,595.091

From Durbin Quadrangle southeast across southwest corner of quadrangle into Hightown Quadrangle.

Bartow, 2.08 miles southeast of, on north edge of road, on top of ledge of rock; chiseled square, telephone-pole marked "U. S. B. M. 3,523.7"	3,523.66

	Feet.
Bartow, 3.95 miles southeast of, 40 feet west of road center, in saddle of road, set in top of concrete post; bronze tablet stamped "W. Va. 1921 H 128 3625", telephone-pole marked "U. S. B. M. 3,624.7"	3,624.617
Witness bench mark, 40.2 feet south of tablet, in west root of 12-inch oak tree; copper nail and washer	3,624.59
Bartow, 4.21 miles southeast of, on west edge of road, at foot of hill, across road from home, in west root of 20-inch sugar tree; copper nail and washer, telephone-pole marked "U. S. B. M. 3,696.5"	3,696.41
Bartow, 5.4 miles southeast of, in sharp turn in road, 30 feet north of lane, in east root of 12-inch oak tree; copper nail and washer, mail-box post marked "U. S. B. M. 3,906.8"	3,906.67

Primary leveling by R. C. Seitz in 1922. (A checked line):

From Circleville Quadrangle, west up trail to Summit of Spruce Knob.

Circleville, 1.50 miles west of, at forks of road, on north side of Reeds Run; chiseled mark on rock at south edge of road	2,596.65
Circleville, 2.1 miles west of, about 0.25 mile below Howard Bennett's house, at sharp bend in road, north edge of road, 2 feet west of 6-inch hickory tree, on rock; chiseled square	3,014.34
Circleville, 2.5 miles west of, at edge of clearing on brow of spur, in root of 18-inch locust tree; copper nail and washer	3,527.85
Circleville, 3 miles west of, in root of oak tree, 12 feet north of trail; nail	3,796.19
Circleville, 3.01 miles west of, in root of ash tree, 10 feet west of trail; nail	3,904.67
Circleville, 3.25 miles west of, in root of beech tree; copper nail	4,294.61
Spruce Triangulation Station and Fire Lookout, on highest part of and near south end of **Spruce Mountain**; bronze tablet set in rock, 10 feet south of southeast corner of Lookout, stamped "4860"	4,860.115
Witness bench mark, on large rock to which guy wire from northeast corner of Lookout is attached, 35 feet north-northeast of bench mark; chiseled square	4,860.63

WARM SPRINGS QUADRANGLE: POCAHONTAS AND GREENBRIER COUNTIES.

(Longitude 38° 00′-38° 15′; Longitude 79° 45′-80° 00′).

Primary leveling by E. E. Harris in 1921:

From Cass Quadrangle southwest along highways through west part of quadrangle into the southeast part of Marlinton Quadrangle.

	Feet.
Frost, 3.01 miles southwest of, on east edge of road, inside fence line, on south bank of Mill Run, in south root of leaning black cherry tree; copper nail and washer, tree marked "U. S. B. M. 2,461"	2,461.31
Frost, 4.12 miles southwest of, 100 feet south of **Moore School,** east edge of road, in south root of tree; copper nail and washer, telephone-pole marked "U. S. B. M. 2,429.1"	2,429.53
Frost, 5.20 miles southwest of, 40 feet west of road, 20 feet south of lane through gate, in top of large rock set in place; bronze tablet stamped "2410 W. Va. 1921 H 167", gate-post marked "U. S. B. M. 2,409"	2,409.779
Reference mark, 46.9 feet south 65° west of tablet, in west root of stump; copper nail and washer	2,410.55
Frost, 6.22 miles southwest of, on east edge of sharp turn in road, inside fence line, in west root of an apple tree; copper nail and washer, fence marked "U. S. B. M. 2,376.3"	2,376.67
Frost, 7.01 mlies southwest of, on west edge of road, 150 feet south of **Mount Carmel Church,** on top of large flat boulder; chiseled square, tree marked "U. S. B. M. 2,367.2"	2,367.57
Frost, 8.18 miles southwest of, 50 feet east of road center, on side of cleared hill, set in top of large sandstone boulder; bronze tablet stamped "2410 W. Va. 1921 H 168", fence marked "U. S. B. M. 2,409.5"	2,409.825
Reference mark, 46.3 feet north 60° west of tablet, in north root of 12-inch apple tree; copper nail and washer	2,414.50
Frost, 9.15 miles southwest of, on east edge of road, on line with lane east through gate, on top of small rock in road; chiseled square, gate-post marked "U. S. B. M. 2,392.3"	2,392.67
Frost, 9.77 miles southwest of, on east edge of angle in road and on north edge of lane east through gate, on top of small boulder; chiseled square, gate-post marked "U. S. B. M. 2,359.8"	2,360.16
Frost, 10.68 miles southwest of, 0.31 mile west of **Minnehaha Springs,** 2.53 miles southeast of **Huntersville,** 30 feet southwest of south end of county bridge over Knapp Creek, set in top of large rock; bronze tablet stamped "2312 W. Va. 1921 H 169", end of bridge rail marked "U. S. B. M. 2,311.9"	2,312.209

	Feet.
Reference mark, 37 feet north 60° east of tablet, in east end of south concrete abutment to bridge over Knapp Creek; chiseled square	2,310.82
Minnehaha Springs, center of road, in front of post-office, telephone-pole marked "U. S. 2,330"	2,330.3
Minnehaha Springs, 0.70 mile south of, in forks of road, on top of large boulder; chiseled square, boulder marked "U. S. B. M. 2,326"	2,326.78
Minnehaha Springs, 1.69 miles south of, 2.60 miles northwest of **Rimel**, on east edge of road, at mouth of hollow, on south root of 12-inch oak tree; copper nail and washer, tree marked "U. S. B. M. 2,356.5"	2,356.83
Minnehaha Springs, 1.69 miles south of, 2.60 miles northwest of **Rimel**, 40 feet east of road center, on south side of hollow, set in top of concrete post; bronze tablet stamped "2359 W. Va. 1921 H 104", fence-post marked "U. S. B. M. 2,359"	2,359.310
Reference mark, 55.7 feet south 50° east of tablet, in root of oak tree; copper nail and washer	2,355.08
Rimel, 1.48 miles northwest of, on north edge of road, 80 feet west of right-angle turn in road, on top face of large sheet rock; chiseled square, rock marked "U. S. B. M. 2,392.6"	2,392.95
Rimel, 0.67 mile northwest of, on south edge of road in top of large stump; copper nail and washer, tree marked "U. S. B. M. 2,421.2"	2,421.54
Rimel, at forks of ╦-road south, 100 feet south of, 30 feet east of, in yard of home owned by R. D. Rimel, Postmaster, set in top of concrete post; bronze tablet stamped "2438 W. Va. 1921 H 170", telephone-pole marked "U. S. B. M. 2,437.9"	2,438.285
Reference mark, 108.6 feet south 20° west of tablet, on top of boulder; chiseled square	2,439.37
Rimel, 0.86 mile south of, on east edge of right-angle turn in road, on west edge of dim road southeast, in north root of 15-inch oak tree; copper nail and washer, tree marked "U. S. B. M. 2,462"	2,462.38
Rimel, 1.68 miles southwest of, on west edge of road, 60 feet north of gate, in east root of forked oak tree; copper nail and washer, tree marked "U. S. B. M. 2,481.1"	2,481.40
Rimel, 2.50 miles southwest of, 40 feet west of road center, 150 feet southeast of house, just east of barn, in east root of large stump; copper nail and washer, gate-post marked "U. S. B. M. 2,500.2"	2,500.52

Feet.

Rimel, 2.97 miles southwest of, 35 feet east of road center, 200 feet south of log road crossing, 120 feet north of shack, set in top of concrete post; bronze tablet stamped "2521 W. Va. 1921 H 171", tree marked "U. S. B. M. 2,520.2".. 2,520.547

Reference mark, 115.6 feet south 10° east of tablet, in north root of large stump; copper nail and washer........... 2,523.80

Rimel, 3.61 miles southwest of, 4.71 miles northeast of **Trainer Post-Office,** on south edge of road, in gap, in west root of 12-inch pine tree; copper nail and washer, tree marked "U. S. B. M. 2,648.6"...................... 2,648.83

Trainer Post-Office, 3.83 miles northeast of, on north edge of road, west side of Sugar Hall Run, 330 feet west of dwelling, in west root of forked oak tree; copper nail and washer, tree marked "U. S. B. M. 2,430.3".......... 2,430.69

From Huntersville, Marlinton Quadrangle, southeast along highways to Minnehaha Springs.

Huntersville, 1.55 miles southeast of, at forks of road, 30 feet east by 60 feet north of, 4 feet west of fence corner, on top of large boulder; chiseled square, telephone-pole marked "U. S. B. M. 2,274.5"......................... 2,274.86

Huntersville, 2.53 miles southeast of, 10.68 miles southwest of **Frost,** and 0.31 mile northwest of **Minnehaha Springs,** 30 feet southwest of south end of county bridge over Knapp Creek, set in top of large rock; bronze tablet stamped "2312 W. Va. 1921 H 169", end of bridge rail, marked "U. S. B. M. 2,311.9"......................... 2,312.209

WEBSTER SPRINGS QUADRANGLE: WEBSTER, NICHOLAS, GREENBRIER, AND POCAHONTAS COUNTIES.

(Latitude 38° 15′-38° 30′; Longitude 80° 15′-80° 30′).

(3 lines omitted; complete levels on this quadrangle will be found on pages 62-64 of Bulletin 632 of the U. S. Geological Survey, and on pages 630-633 of the Webster County Report of the West Virginia Geological Survey. Parts of two lines are given below).

From Upper Glade southeast 12 miles along highway up Williams River.

(4 levels omitted here).

Dyer Post-Office, 3.7 miles east of, south side of road, in root of tree; copper nail with washer stamped "U. S. G. S. W. Va. B. M.", marked "U. S. B. M. 2,311"....... 2,311.57

Dyer Post-Office, 4.8 miles east of, north side of road, in root of tree; copper nail with washer stamped "U. S. G. S. W. Va. B. M.", marked "U. S. B. M. 2304"............... 2,305.10

	Feet.
Dyer Post-Office, 6.4 miles east of, about 600 feet northwest of house of Jacob Mullens, about 150 feet north of apple tree, north side of fence, in ledge; bronze tablet stamped "2353"	2,354.006
Dyer Post-Office, 7.6 miles east of, about 1 mile above Jacob Mullens' house, where trail crosses creek, on boulder; chiseled square, marked "U. S. B. M. 2384" (on single spur line)	2,384.88

From point 2.6 miles north of Richwood east 20 miles along log railroad (leveled twice).

(4 levels omitted here).

Dogway, 30 feet west of water-tank, south side of track, in root of stump; copper nail with washer, stamped "U. S. G. S. W. Va. B. M.", marked "U. S. B. M. 3099"	3,100.85
Dogway, 1.6 miles northwest of, 150 feet southwest of switch, in ledge; bronze tablet stamped "2911"	2,912.787
Dogway, 1.1 miles east of mouth of, north side of track, in root of stump; copper nail with washer, stamped "U. S. G. S. W. Va. B. M.", marked "U. S. B. M. 2974"	2,975.16
Dogway, 2.1 miles east of mouth of, east side of track, west side of river, in root of tree; copper nail with washer, stamped "U. S. G. S. W. Va. B. M.", marked "U. S. B. M. 3030"	3,031.30
Dogway, 3.3 miles east of mouth of, 20 feet south of track, in large boulder; bronze tablet stamped "3090"	3,091.213

GAZETTEER OF POCAHONTAS COUNTY.

By R. C. Tucker, Assistant Geologist.

The following is an alphabetic list of the place names shown on Maps I and II accompanying this Report in the Atlas. All names occurring in Pocahontas County are listed as also those in the immediate region of the adjoining counties, but those located several miles from the Pocahontas boundary are not indexed, since several of these will be eliminated on Map II by the cross-sections printed thereon. In the case of streams, the distance (air-line) given from the town named is to the mouth and not the point on the map where the name is printed. Where the mouth of a stream is not in Pocahontas County, the point where it crosses the county line is given. The elevations of the towns and the highest points on the mountains are shown in parentheses following the place name. A plus (+) sign indicates that the elevation is higher than the figure shown but less than one contour interval (50 feet). A plus-minus (±) sign indicates that the elevation has been interpolated from the topographic contours and may be in error a few feet either way. The list will no doubt prove of value to those unfamiliar with Pocahontas County and will facilitate the ready finding of the points named in the text and appendix showing levels immediately preceding:

Abe Run (of East Fork of Greenbrier River, 5.3 miles northeast of Thornwood P. O.).

Allegheny Mountain (4587′) eastern boundary, along Bath and Highland Counties, Virginia).

Allegheny Run (of Greenbrier River, at Hosterman, 5.1 miles northeast of Cass).

Allegheny School (3649′) (in Virginia, at head of Buffalo Fork of Little River of East Fork of Greenbrier River, 5.0 miles southeast of Thornwood, P. O.).

Anthony Creek (southeast corner of county, 2.5 miles west of Greenbrier County corner with Bath Co., Va., at Hightop).

Arbovale (2727′) (on Hospital Run of Deer Creek, 1.5 miles northeast of Green Bank).

Asbury Knob (3304′) (4.0 miles northeast of Dunmore, 1.4 miles south of Green Bank).

August (2165′) (on Greenbrier River, opposite Lewis Lick Run, 3.0 miles northeast of Marlinton).

Back Allegheny Mountain (4842′) (west of Greenbrier River, 3.0 miles west of Cass, and northward 15 miles).

Back Draft (of Rosen Run, 4.9 miles northeast of Dunmore, 0.8 mile southeast of Green Bank).

Bald Knob (4400′+) (3.4 miles northwest of Buckeye).

Bald Knob (fire tower, 4842′; triangulation point, 4808′) (on Back Allegheny Mountain, 3.5 miles north of Cass).

Bannock Shoals Run (of Williams River, 2.4 miles southeast of Webster County line).

Barclay Run (of Knapp Creek, 0.7 mile northwest of Minnehaha Springs).

Barlow Top (4600′) (knob on Black Mountain, 7.0 miles west of Marlinton.

Bartow (2782′) (on West Fork of Greenbrier River, 2.3 miles east of Durbin).

Bath County (Virginia, south of Highland County, to Greenbrier County line).

Bayard Knob (4155′) (on Randolph County line, 12.0 miles northeast of Durbin).

Bear Mountain (4467′) (on Allegheny Mountain, 8.2 miles northeast of Green Bank, on Virginia line).

Bear Run (of North Fork of Cherry River, 0.3 mile west of Greenbrier County line).

Beard (2010′) (2.3 miles north of Greenbrier County line, on Greenbrier River).

Bearpen Hollow (of Sutton Run of North Fork of Deer Creek, 4.1 miles east of Green Bank).

Beartree Run (of Thorny Creek, 0.9 mile up, 1.4 miles east of August).

Bearwallow Run (of East Fork of Greenbrier River, 3.5 miles northeast of Thornwood P. O.).

Beaver Creek (of Greenbrier River, at Violet, 9½ miles north of Greenbrier County line).

Beaver Creek (of Shavers Fork of Cheat River, 1 mile north of Pocahontas County line, 5.2 miles west of Nottingham P. O.).

Beaver Creek School (2428′) (4.0 miles southeast of Violet, on Beaver Creek).

Beaver Lick Mountain (3662′, White Rocks) (southeastern part of county, 8.0 miles west of Virginia line, 7.0 miles east of Greenbrier River).

Beaverdam Run (of Williams River, 11.2 miles southeast of Webster County line).

Beaverdam School (3540′±) (5.0 miles west of Marlinton, on Beaverdam Run).

Beech Flat Knob (4700′+) (in Randolph County, west of Shavers Fork of Cheat River, 2.7 miles north of Spruce).

Beech Mountain (4050′+) (northeast corner of county 11.0 miles northeast of Durbin).

Beechy Run (of Middle Fork of Williams River, 2.5 miles up).

Bennett Run (of East Fork of Greenbrier River, 12.0 miles northeast of Durbin).

Bethel School (2750′±) (4.0 miles southwest of Frost, 4.4 miles east of Clawson).

Beulah Church (2350′±) (at mouth of Boggs Run of Robbins Run, 4.0 miles southwest of Lobelia, in Greenbrier County).

Big Ridge (3407′) (east of head of Gum Branch of Sitlington Creek, 3.0 miles northeast of Dunmore).

Big Ridge (3000′-3250′) (north of Beartree Run, 5.0 miles northeast of Marlinton).

Big Ridge (3200′+) (west of Knapp Creek and Mt. Vernon Church, 8.0 miles northeast of Minnehaha Springs).

Big Run (of Buffalo Fork of Little River of East Fork of Greenbrier River, 3.2 miles southeast of Thornwood P. O.).

Big Run (of Elk River, 2.0 miles south of Randolph County line, 2.1 miles north of Slaty Fork).

Big Run (of Greenbrier River, 1.4 miles northeast of Clover Lick).

Big Run (town) (2249′) (on Greenbrier River, 7.5 miles northeast of Marlinton).

Big Sandy Run (of Cochran Creek, 1 mile southwest of Rimel).

Big Spring Fork (of Elk River, at Slaty Fork).

Big Spruce Knob (4695′) (6.6 miles northwest of Marlinton).

Birchlog Run (of Cranberry River, 0.8 mile northeast of Webster County line, 10.2 miles northwest of Lobelia).

Bird Run (of Knapp Creek, 1.6 miles east of Frost, 10.7 miles northeast of Minnehaha Springs).

Black Mountain (4625′) (west of head of Williams River).

Black Mountain Run (of Williams River, 9.0 miles southeast of Webster County line, 7.5 miles northwest of Marlinton).

Black Run (of North Fork of Deer Creek, 5.2 miles east of Green Bank).

Black Run (of Shavers Fork of Cheat River, 1.0 mile south of Spruce).

Black Run (of Shavers Fork of Cheat River, 1.5 miles north of Hopkins).

Blackhole Run (of Elk River, 0.5 mile south of Randolph County line, 5.1 miles west of Mace).

Blister Swamp (3637′) (head of East Fork of Greenbrier River, 12.7 miles northeast of Durbin).

Blue Knob (4426′) (3.2 miles northeast of Lobelia, head of Bruffey Creek).

Blue Lick Run (of Stamping Creek, 2.1 miles northwest of Mill Point).

Blue Lick School (2550′±) (on Stamping Creek, 3.0 miles northwest of Mill Point).

Boggs Run (of Robbins Run, 4.2 miles southwest of Lobelia).

Boggs Run School (2707′) (on Boggs Run, 3.0 miles southwest of Lobelia).

Bowman Ridge (3387′) (west of Greenbrier River, 2.5 miles southwest of Nottingham P. O.).

Boyer (2700′±) (on Deer Creek, 4.0 miles north of Arbovale).

Boyer Station (Nottingham P. O.) (2662′) (on Greenbrier River, 2.5 miles southwest of Durbin).

Brady School (2700′±) (on Dry Fork of Elk River, 3.9 miles west of Mace).

Braucher (2880′±) (on West Fork of Greenbrier River, 3.8 miles north of Durbin).

Briery Knob (4518′) (3.0 miles northwest of Lobelia, on Yew Mountains).

Browns Creek (of Knapp Creek, 4.5 miles southeast of Marlinton, north of Huntersville).

Browns Creek School (2315′±) (on Browns Creek of Knapp Creek, 2.5 miles northeast of Huntersville).

Browns Mountain (3245′, The Horse Ridge) (east of Browns Creek and west of Knapp Creek, 2.5 miles north of Minnehaha Springs).

Brownsburg (2621′) (2.2 miles northwest of August, 3.0 miles northeast of Marlinton).

Bruffey Creek (of Hills Creek, 0.5 mile east of Lobelia).

Brush Camp Low Place (4250′—) (head of Big Run of Elk River, 2.5 miles southwest of Randolph corner on Elk River, 2.8 miles northwest of Slaty Fork).

Brush Lick Run (of Greenbrier River, 2.8 miles northeast of Marlinton).

Brush Run (of Greenbrier River, 0.7 mile south of Nottingham P. O.).

Brush Run School (2850′±) (on Brush Run of Greenbrier River, 0.8 mile north of Boyer, 3.2 miles southeast of Nottingham P. O.).

Brushy Flat School (2560′±) (on Sideling Run, 1.5 miles northwest of August).

Brushy Mountain (3671′) (range east of Beaver Lick Mountain, north end, 2.0 miles southwest of Minnehaha Springs).

Buck Knob (4250′+) (between Yew and Gauley Mountains, 4.5 miles southwest of Slaty Fork).

Buck Mountain (3118′) (2.0 miles west of Marlinton).

Buck Run (of Shavers Fork of Cheat River, 0.4 mile north of Hopkins).

Buck Run (of Swago Creek, 0.9 mile north of Buckeye).

Buck Run School (2380′±) (1.3 miles up Buck Run of Swago Creek, 1¾ miles southwest of Marlinton).

Buckeye (2106′) (on Greenbrier River, 3.5 miles southwest of Marlinton).

Buckley Mountain (3383′) (west of Cummins Creek, 2 miles west of Huntersville).

Buffalo Fork (of Little River of East Fork of Greenbrier River, 1.3 miles southeast of Thornwood P. O.).

Buffalo Ridge (4400′+) (north of North Fork of Deer Creek, 4.5 miles northeast of Green Bank).

Buffalo Ridge School (4310′±) (on Buffalo Ridge, 4.6 miles northeast of Green Bank).

Buffalo Run (of Deer Creek, 1.9 miles north of Arbovale).

Burner (2917′) on West Fork of Greenbrier River, at mouth of Little River, 5.0 miles north of Durbin).

Burner Mountain (4300′+) (between East and West Forks of Greenbrier River, southeast of Little River, northeast of Durbin to Blister Swamp region).

Burner Settlement (on Burner Mountain, 3.5 miles northeast of Durbin).

Burning Run (of East Fork of Greenbrier River, 6.1 miles northeast of Thornwood P. O.).

Burning School (3875′±) (on Burning Run, 7.1 miles northeast of Thornwood P. O.).

Burnsides (2026′) (5.0 miles north of Greenbrier County line on Greenbrier River, 1 mile west of Kennison).

Burr (3000′±) (½ mile north of Greenbrier County line on Beaver Lick Mountain, 11.3 miles south of Marlinton).

Burr School (2603′) (near head of Laurel Run of Greenbrier River, in Burr Valley, 5.5 miles east of Denmar).

Burr Valley (near head of Laurel Run of Greenbrier River, 5.0 miles east of Denmar).

Buzzard Hollow (of Knapp Creek, 1.7 miles southeast of Huntersville, 1.0 mile northwest of Minnehaha Springs).

Buzzard Ridge (4295′) (north of Old Field Fork of Elk River, 7.0 miles west of Stony Bottom).

Caesar Mountain (3300′+) (2 miles northeast of Lobelia).

Caesar Mountain School (2994′) (2 miles northeast of Lobelia, near sink of Cave Run).

Camp Hollow (of Douthat Creek of Knapp Creek, 0.5 mile south of Minnehaha Springs).

Campbell Run (of East Fork of Greenbrier River, 4.2 miles northeast of Thornwood P. O.).

Campbelltown (2150′) (on Stony Creek, 0.5 mile up, and 1.3 miles north of Marlinton).

Cashcamp Run (of North Fork of Cranberry River, 1.5 miles up).

Cass (B. M. 2452′; 2441′) (on Greenbrier River, 11.5 miles southwest of Durbin, and 15.3 miles northeast of Marlinton).

Cave Run (of Bruffey Creek, ¾ mile northeast of Lobelia).

Charles Creek (of Cranberry River, 5.1 miles southeast of Webster County line, 5.1 miles north of Lobelia).

Charley Ridge (3100′+) (west of Gum Branch of Sitlington Creek, 1.8 miles northeast of Dunmore).

Cheat Mountain (4839′, Thorny Flat) (west of Shavers Fork, 4.5 miles northwest of Cass).

Cherry Grove School (3101′) (1.3 miles west of Nottingham P. O.).

Cherry River (See North and South Forks).

Chestnut Flats (3581′) (2.1 miles northwest of Lobelia).

Chestnut Levels (3678′) (on Bath County, Va., line, 12.0 miles east of Marlinton).

Chestnut Ridge (4000'-4400') (south of Galfred Run, 6.00 miles east of Dunmore).

Chicken House Run (of Greenbrier River, 0.4 mile south of Watoga, 8.1 miles north of Greenbrier County line).

Circle Mountain School (2807') (2.3 miles northwest of Minnehaha Springs, on Miller Ridge).

Clawson (2183') (on Greenbrier River, 4.7 miles northeast of Marlinton).

Cloverfield Hollow (of Knapp Creek, 4.8 miles northeast of Minnehaha Springs).

Clover Lick (town) (2289') (on Greenbrier River, 10.3 miles northeast of Marlinton, at mouth of Cloverlick Creek).

Cloverlick Creek (of Greenbrier River, at Clover Lick, 2.2 miles south of Stony Bottom).

Cloverlick Mountain (4280') (south of Cloverlick Creek, 3.8 miles west of Clover Lick, 7.5 miles northeast of Marlinton).

Clubhouse Run (of Little River of West Fork of Greenbrier River, 7.3 miles northeast of Durbin, 2.9 miles southeast of May).

Coal Run (of Middle Fork of Williams River, 5.5 miles up).

Cochran Creek (of Laurel Creek of Knapp Creek, 0.2 mile west of Rimel, 3.2 miles southeast of Minnehaha Springs).

Colaw Knob (4218') (on Poca Ridge, 4.8 miles northeast of Thornwood P. O., 1.3 miles northwest of Pendleton-Highland County corner).

Cold Run (of Greenbrier River, 0.4 mile south of Cass).

Cold Run School (2775'±) (1.1 miles up Cold Run, 1.3 miles west of Cass).

Cooper Run (of Rosen Run, 1¼ miles southeast of Green Bank).

County Line Branch (of Williams River, at Webster County line, 8.4 miles southeast of Slaty Fork).

Cove Hill School (2650'±) (on Sugarcamp Run, 0.9 mile north of Frost).

Cranberry Glades (3400') (on Cranberry River, 5.0 miles southeast of Webster County line, 9.5 miles west of Marlinton).

Cranberry Mountain (4300'+) (between Cranberry River and Stamping Creek, 4.5 miles northwest of Mill Point).

Cranberry River (west end of county, 15.0 miles northwest of Marlinton).

Crooked Fork (of Old Field Fork of Elk River, 7.0 miles north of Marlinton).

Crooked Fork School (3090'±) (on Old Field Fork of Elk River, 7.0 miles north of Marlinton, opposite mouth of Crooked Fork).

Cub Ridge (3900'-4200') (head of North Fork of Gauley River, 3.0 miles west of Slaty Fork).

Cummins Creek (of Knapp Creek, north of Huntersville, 4.6 miles southeast of Marlinton).

Cummins Creek School (2519') (near head of Cummins Creek, 3.0 miles southwest of Huntersville).

Cup Run (of Big Spring Fork of Elk River, 6.3 miles northwest of Cass).

Cup Run (of Greenbrier River, 2.1 miles northeast of Cass).

Day Mountain (4250'+) (3.6 miles northwest of Marlinton).

Day Run (of Williams River, 6.8 miles southeast of Webster County line, 7.8 miles northwest of Marlinton).

Dean Hollow (of Hills Creek, 1 mile northwest of Lobelia).

Deer Creek (of Greenbrier River, 0.5 mile south of Cass).

Deer Creek (town) (2416') (on Greenbrier River, 1 mile south of Cass).

Deever Run (of Greenbrier River, 1.9 miles northeast of Cass).

Denmar (2023′) (on Greenbrier River, 3.0 miles north of Greenbrier County line, 12 miles southwest of Marlinton).

Devils Garden (2900′+) (on Douthat Creek, 4.0 miles southwest of Minnehaha Springs).

Dilleys Mill (2575′±) (on Thorny Creek, 4.5 miles up, and 8.0 miles northeast of Marlinton).

Dogway (3101′) (on Dogway Fork of Cranberry River, 1.4 miles from mouth, in Webster County).

Dogway Fork (of Cranberry River, 1.3 miles west of Webster County line).

Douglas Fork (of Dry Fork of Elk River, 3.4 miles west of Mace).

Douthat Creek (of Laurel Creek of Knapp Creek, 1.2 miles south of Minnehaha Springs).

Douthat Creek School (2440′±) (on Douthat Creek, 2.5 miles southwest of Minnehaha Springs).

Downy Run (of Williams River, 11.4 miles southeast of Webster County line, 5.7 miles west of Marlinton).

Droop Mountain (3580′) (1.7 miles west of Spice Run—Locust P. O., west of Greenbrier River, 3.7 miles west of Denmar).

Droop Mountain Battlefield Park (3050′±) (at Spice, on Droop Mountain, 2.5 miles west of Mill Run).

Dry Creek (of Stony Creek, 2.0 miles north of Marlinton).

Dry Creek (of Swago Creek, 1 mile north of Buckeye).

Dry Creek School (2200′+) (on Dry Creek of Swago Creek, 1.1 miles north of Buckeye).

Dry Fork (of Elk River, 5.0 miles northwest of Mace, and 4.0 miles north of Slaty Fork).

Dry Run (of Anthony Creek, mouth in Greenbrier County 0.5 mile south of Pocahontas line).

Duncan Run (of Deer Creek, 1.1 miles north of Arbovale).

Dunmore (2463′) (on Sitlington Creek, 2.5 miles east of Sitlington).

Durbin (B. M. 2730; 2721′) at junction of East and West Forks of Greenbrier River, 11.5 miles northeast of Cass).

Duysard Ridge (3340′) (west side of Greenbrier River, 4.0 miles northeast of Cass).

Eagles Camp (3300′) (on North Fork of Cherry River, 0.3 mile east of Greenbrier County line, 5.3 miles northwest of Lobelia).

Eagles School (2700′±) (on Hills Creek, 2.1 miles northwest of Lobelia).

East Fork (of Glady Fork, north of Randolph County line, 2.2 miles northeast of Wildell).

East Fork (of Greenbrier River) (at Durbin).

Edray (2409′) (on Indian Draft of Stony Creek, 3.5 miles north of Marlinton).

Edray District (northwest part of county).

Elbow Run (of Williams River, 3.5 miles northeast of Three Forks of Williams).

Elk Creek (of Greenbrier River, 0.5 mile north of Nottingham P. O.).

Elk Mountain (4250′+) (on Virginia line, 7.5 miles northeast of Thornwood P. O.).

Elk Mountain School (3865′±) (in Virginia, 7.2 miles northeast of Thornwood P. O.).

Elk River (crosses county line 5 miles northwest of Mace, and 4 miles north of Slaty Fork).

Elklick Run (of Clubhouse Run of Little River of West Fork of Greenbrier River, 7.5 miles northeast of Durbin).

Elklick Run (of Greenbrier River, 0.2 mile southwest of Stony Bottom).

Elklick Run (of West Fork of Greenbrier River, 9.0 miles north of Durbin).

Elleber Ridge (4602′) (spur of Allegheny Mountain, at head of a southeast branch of North Fork of Deer Creek, 6.0 miles east of Green Bank).

Elleber Run (of North Fork of Deer Creek, 7.0 miles northeast of Green Bank).

Evic Hollow (of Knapp Creek, 4.3 miles northeast of Minnehaha Springs).

Fairview School (2725′±) (0.6 mile west of Harter, 5.6 miles northeast of Marlinton).

Fallen Timber Run (of Anthony Creek, in Greenbrier County, 2.0 miles southwest of Pocahontas line).

Fallen Timber Run (of North Fork of Cherry River, 1.6 miles southwest of Webster-Greenbrier County corner).

Falls of Hills Creek (on Hills Creek, 3.7 miles northwest of Lobelia).

Fill Run (of West Fork of Greenbrier River, 2.5 miles north of Durbin).

Fill Run School (3225′±) (on Fill Run, 1 mile west of mouth, 2.4 miles northwest of Durbin).

First Fork (of Shavers Fork of Cheat River, 4.3 miles southwest of Durbin).

Fitzwater Branch (of Robbins Run, 0.1 mile north of southwest Greenbrier-Pocahontas corner, 4.0 miles southwest of Lobelia).

Fivemile Hollow (of East Fork of Greenbrier River, 1.8 miles northeast of Thornwood P. O.).

Flat Ridge (4200′+) (spur of Gauley Mountain, 1.5 miles southwest of Slaty Fork).

Fork Mountain (4218′) (northeast of Buffalo Fork, 1.7 miles east of Thornwood P. O.).

Fox Run (of West Fork of Greenbrier River, 10.3 miles north of Durbin).

Frank (2736′) (on East Fork of Greenbrier River, 1 mile east of Durbin).

Frank Mountain (3907′) (west of Little River of East Fork of Greenbrier River, 5.8 miles east of Nottingham P. O.).

Friel Run (of Laurel Creek of Williams River, 6.8 miles northwest of Marlinton).

Frost (2589′) (on Knapp Creek, 9.6 miles northeast of Minnehaha Springs).

Frosty Gap (4000′+) (at head of Dogway Fork of Cranberry River, 2.0 miles southeast of Webster-Greenbrier-Pocahontas County corner, 6.0 miles northwest of Lobelia).

Galford Run (of Williams River, 6.6 miles southeast of Webster County line, 8 miles northwest of Marlinton).

Galfred Ridge (3238′) (west side of Greenbrier River, 3.2 miles northeast of Cass).

Galfred Run (of Sitlington Creek, 5.0 miles northeast of Dunmore).

Gandy Creek (northeast corner of county, in Randolph County, 8.0 miles southeast of Wildell).

Gate Hollow (of Knapp Creek, 5.2 miles northeast of Minnehaha Springs).

Gauley Mountain (4710′, Spruce Knob), (west of Elk River, 2.0 miles west of Slaty Fork, about 12 miles long).

Gauley River (at Three Forks of Gauley, 6.0 miles west of Slaty Fork).

Gay Knob (4545') (6.5 miles north of Marlinton, 5.7 miles west of Clover Lick).

Gertrude (2990'±) (on West Fork of Greenbrier River, at mouth of Gertrude Run, 9.0 miles north of Durbin).

Gertrude Run (of West Fork of Greenbrier River, 8.9 miles north of Durbin).

Gibson Knob (4415') (7.6 miles southwest of Cass, southeast end of Slaty Ridge, 5.7 miles northwest of Clover Lick).

Glade Run (of Cloverlick Creek, at Clover Lick, 10.3 miles northeast of Marlinton).

Grassy Knob (3910') (on Little Ridge, 4.2 miles southeast of Thornwood P. O.).

Grassy Ridge School (3100'±) (in Burner Settlement, 3.3 miles northeast of Durbin).

Grassy Run (of Poca Run of East Fork of Greenbrier River, 2.5 miles northeast of Thornwood P. O.).

Green Bank (P. O.) (2640'±) (on North Fork of Deer Creek, 5.0 miles northeast of Cass).

Greenbank District (northeastern part of county).

Greenbrier River (formed by junction of East and West Forks at Durbin, flowing southwestward through central part of county, crossing Greenbrier County line 0.6 mile south of Spice Run—Locust P. O.).

Green Hill School (2475'±) (on Stony Creek, 1.6 miles up, 2.0 miles north of Marlinton).

Griffin Run (of North Fork of Deer Creek, 7.0 miles northeast of Green Bank).

Grimes School (2460'±) (on Tilda Fork of Stamping Creek, 1.5 miles northwest of Mill Point).

Grindstone Knob (3200'+) (on Browns Mountain, 4.6 miles northeast of Minnehaha Springs).

Guinn Ridge (4000'-4500') (at head of Galfred Run of Sitlington Creek, between forks, 7.0 miles east of Dunmore).

Gum Branch (of Sitlington Creek, 0.8 mile east of Dunmore).

Gum Cabin Hollow (of East Fork of Greenbrier River, 1.1. miles northeast of Thornwood P. O.).

Gum Spring School (2690'±) (on Gum Branch of Sitlington Creek, 2.4 miles northeast of Dunmore).

Guy Run (of Knapp Creek, 5.2 miles northeast of Minnehaha Springs).

Halfway Run (of Greenbrier River, at Knapp, 2.6 miles northeast of Marlinton).

Hamilton Hollow (of Knapp Creek, 3.9 miles northeast of Minnehaha Springs).

Hamilton Hollow (of North Fork of Deer Creek, 3.2 miles east of Green Bank).

Hamilton Lick Run (of Anthony Creek, 1.3 miles northeast of Greenbrier County line, 4.2 miles southwest of Rimel).

Hannah School (2845'±) (on Old Field Fork of Elk River, 8.7 miles west of Stony Bottom).

Harter (2211') (on Greenbrier River, 5.0 miles northeast of Marlinton).

Hateful Run (of Williams River, 1.8 miles southeast of Webster County line, 8.2 miles southwest of Slaty Fork).

Hawohen Hollow (of East Fork of Greenbrier River, 3.8 miles east of Durbin).

Hefner School (2675'±) (on Overholt Run of Swago Creek, 2.4 miles northwest of Buckeye).

Hell for Certain Branch (of Middle Fork of Williams River, 4.0 miles up, 12.5 miles southwest of Slaty Fork).

Hevener Church (3025'±) (2.3 miles southwest of Nottingham P. O. near head of Allegheny Run).

High Rock (4450') (on Black Mountain, 4.1 miles northwest of Buckeye).

Highland County (Virginia, north of Bath County, to Pendleton County).

Hightop (3645') (0.4 mile north of southeast Pocahontas-Greenbrier corner, on Virginia line).

Hills Creek (sinks northwest of Droop Mountain, 1.3 miles southeast of Lobelia).

Hillsboro (2302') (2.0 miles west of Seebert, 2.0 miles north of Burnsides).

Hillside School (2550') (on Gum Branch of Sitlington Creek, 1.4 miles southeast of Dunmore).

Hinkle Run (of Little River of West Fork of Greenbrier River, 9.0 miles northeast of Durbin).

Hock Knob (3950'+) (2.0 miles southwest of Lobelia).

Hoover School (3207') (1.5 miles west of Durbin).

Hopkins (3683') (Randolph County, 6.5 miles west of Durbin, on Shavers Fork of Cheat River).

Hospital Run (of Deer Creek, 0.9 mile northwest of Arbovale).

Hosterman (2582') (on Greenbrier River, 6.2 miles northeast of Cass).

Huntersville (2266') (on Knapp Creek, at mouths of Browns and Cummins Creeks, 5.0 miles southeast of Marlinton).

Huntersville District (southeastern part of county).

Hunting Run (of North Fork of Cranberry River, 1.2 miles up).

Improvement Lick Run (of Greenbrier River, 4.7 miles southwest of Marlinton).

Indian Draft (of Stony Creek, 1.2 miles north of Marlinton).

Irvin Hollow (of Knapp Creek, 3.7 miles northeast of Minnehaha Springs).

Island Lick Run (of Greenbrier River, 1 mile northeast of Kennison).

Jacox (2627') (3.0 miles south of Lobelia, 5.2 miles west of Denmar).

Jacox Knob (4046') (2.3 miles southwest of Lobelia).

Jakes Run (of Sitlington Creek, 2.8 miles east of Dunmore).

Jericho Flat (2500'+) (opposite Marlinton, west of Greenbrier River).

Johns Run (of East Fork of Greenbrier River, 1.4 miles east of Durbin).

Kee Flats (2450'-2500') (west of Greenbrier River, 2.0 miles southwest of Marlinton).

Kee Hollow (of Greenbrier River, opposite south end of Marlinton).

Kennison (2036') (5.3 miles northeast of Greenbrier County line, on Greenbrier River, 9.5 miles southwest of Marlinton).

Kennison Mountain (3750'+) (southwest corner of county, 3 miles southwest of Lobelia).

Kennison Mountain (4450'+) (west of Cranberry Glades, 11 miles west of Marlinton).

Kerr School (2800'±) (on Saulsbury Run of Deer Creek, 3.2 miles northeast of Arbovale).

Kins Creek (of Williams River, 2.1 miles southeast of Webster County line, 8.2 miles southwest of Slaty Fork).

Kline Hollow (of Douthat Creek, 2.1 miles southwest of Minnehaha Springs).

Knapp (2155') (on Greenbrier River, at mouth of Halfway Run, 2.5 miles northeast of Marlinton).

Knapp Creek (of Greenbrier River, south end of Marlinton).

Lambs Run (of Duncan Run of Deer Creek, 1.7 miles northeast of Arbovale).

Laurel Creek (of Knapp Creek, Rimel region, mouth at Minnehaha Springs).

Laurel Creek (of Williams River, 5.6 miles southeast of Webster County line, 8.3 miles southwest of Slaty Fork).

Laurel Run (of Anthony Creek, 0.4 mile north of Greenbrier County line).

Laurel Run (of Brush Run of Greenbrier River, 2.0 miles east of Nottingham P. O.).

Laurel Run (of Cochran Creek, 2.6 miles southwest of Rimel).

Laurel Run (of Elk River, at Slaty Fork, 4.0 miles south of Randolph County line).

Laurel Run (of Greenbrier River, 0.5 mile north of Denmar, 3.5 miles north of Greenbrier County line).

Laurel Run (of Greenbrier River, opposite Harter).

Laurel Run (of Greenbrier River, 0.4 mile north of Clover Lick).

Laurel Run (of Hills Creek, 2.3 miles northwest of Lobelia).

Laurelly Branch (of Middle Fork of Williams River, 3.1 miles up, 13 miles southwest of Slaty Fork).

Leatherbark Run (of Greenbrier River, at north edge of Cass).

Left Fork (of North Fork of Cranberry River, 3.0 miles up, 9 miles north of Lobelia).

Left Prong (of Galfred Run of Sitlington Creek, 6.0 miles east of Dunmore).

Lewis Lick Run (of Greenbrier River, opposite August, 3.0 miles northeast of Marlinton).

Lick Creek (of Tea Creek, 6.7 miles southwest of Slaty Fork).

Lick Run (of Poca Run of East Fork of Greenbrier River, 2.9 miles northeast of Thornwood P. O.).

Linwood (2942') (on Big Spring Fork of Elk River, 7.0 miles northwest of Cass).

Little Beech Mountain (3500'+) (north end of county, 2.5 miles northeast of Wildell).

Little Beechy Run (of Middle Fork of Williams River, 1.6 miles up, 11.3 miles northwest of Woodrow).

Little Branch (of Cranberry River, 4.9 miles southeast of Webster County line, 10.5 miles west of Marlinton).

Little Laurel Creek (of Williams River, 5.4 miles southeast of Webster County line, 9 miles northwest of Marlinton).

Little Levels (2300'+) (Hillsboro region, 3 miles, northeast-southwest).

Little Levels District (southwestern part of county).

Little Mountain (3425') (east side of Greenbrier River, from Cass to Nottingham P. O.).

Little Mountain (3100') (north of Rainbow Run of Browns Creek, 4.6 miles north of Minnehaha Springs).

Little Mountain (3450'+) (2.5 miles north of Hillsboro, south of Stamping Creek).

Little Red Run (of Cranberry River, 3.7 miles southeast of Webster County line, 11.3 northwest of Marlinton).

Little Ridge (4530') (spur of Allegheny Mountain, between Tacker Fork and Sutton Run of North Fork of Deer Creek, 5.0 miles east of Green Bank).

Little River (of East Fork of Greenbrier River, at Thornwood P. O., 5.0 miles east of Durbin).

Little River (of West Fork of Greenbrier River, 5.1 miles north of Durbin).

Little Spruce Knob (4260′) (1.1 miles north of Big Spruce Knob, 7.2 miles northwest of Marlinton).

Little Spruce Ridge (3550′+) (east of Little River of East Fork of Greenbrier River, 3.0 miles southeast of Thornwood P. O.).

Little Thorny Creek (of Thorny Creek, 2.6 miles southeast of Big Run, 1.3 miles northeast of Dilleys Mill).

Lobelia (2505′) (on Hills Creek, 4.5 miles northwest of Mill Run, 12¾ miles southwest of Marlinton).

Lockridge Mountain (3175′) (1.5 miles east of Minnehaha Springs).

Lockridge Run (of Laurel Creek of Knapp Creep, 3.0 miles east of Minnehaha Springs).

Locust (1998′) (1.8 miles north of Greenbrier County line, on Greenbrier River, 13.6 miles southwest of Marlinton).

Locust Creek (of Greenbrier River, mouth at Locust, 1.7 miles north of Greenbrier County line).

Locust Creek Church (2100′±) (1.6 miles up Locust Creek, 2.0 miles west of Denmar).

Locust Creek School (2085′±) (2.6 miles up Locust Creek, 1.6 miles west of Mill Run).

Locust Knob (4310′) (1.5 miles southeast of Big Spruce Knob, 5.1 miles northwest of Marlinton).

Locust P. O. (Spice Run) (1987′) (0.5 mile north of Greenbrier County line, on Greenbrier River, 14.5 miles southwest of Marlinton).

Long Run (of Poca Run of East Fork of Greenbrier River, 2.3 miles northeast of Thornwood P. O.).

Lost Bottom Run (of Cochran Creek, 2.0 miles southwest of Rimel).

Lost Run (of Cranberry River, 3.0 miles southeast of Webster County line, 11.8 miles northwest of Marlinton).

Lower Bannock Shoals Run (of Williams River, 0.7 mile southeast of Webster County line, 8.2 miles southwest of Slaty Fork).

Lower Mountain (3033′) (east of Moore Run of Sitlington Creek, 0.7 mile northeast of Dunmore).

Lucy Draft (of Knapp Creek, 1.7 miles northeast of Minnehaha Springs).

Lynn Divide (3965′) (northern part of county on Randolph County line, 2.5 miles east of Wildell).

Lynn Knob (4015′) (on Middle Mountain, 9.8 miles northeast of Durbin, 3.5 miles northeast of May).

McClintock Run (of Middle Fork of Williams River, 5.8 miles up, 11.7 miles northwest of Marlinton).

McClintock Run (of Swago Creek, 0.9 mile up, from Buckeye).

McLaughlin Church (2871′±) (on Cold Run of Greenbrier River, 1.3 miles west of Cass).

McLaughlin Hollow (of Moore Run of Knapp Creek, 7.8 miles northeast of Minnehaha Springs).

McLaughlin School (2490′±) (on Thomas Creek, 2.0 miles southeast of Sitlington).

McLaughlin Springs (2360′±) (on Dry Creek of Stony Creek, ¾ mile southwest of Edray).

Mace (3464′) (at Randolph-Pocahontas County corner at Edray-Greenbank District line, 7.5 miles northwest of Cass).

Mace Knob (4705′) (on Cheat Mountain, 6.3 miles northeast of Cass).

Mace School (3260′±) (on head of Dry Fork of Elk River, 0.9 mile southeast of Mace).

Mad Sheep (4256') (Virginia, high point on Allegheny Mountain, 9.6 miles northeast of Minnehaha Springs).

Mad Sheep Ridge (3250'-3500') (north of Moore Run of Knapp Creek, 10 miles northeast of Minnehaha Springs).

Mad Tom (4050'+) (on Virginia line, 8.8 miles northeast of Minnehaha Springs).

Maple Grove School (2343') (0.3 mile west of Greenbrier River, 1.2 miles northwest of Spice Run—Locust P. O.).

Marble Run (southeast of Little Mountain, sinks 1.7 miles northeast of Hillsboro, 1.4 miles west of Mill Point).

Marlin Mountain (3422') (between Greenbrier River and Knapp and Browns Creeks, east of Marlinton).

Marlin Run (of Knapp Creek, 0.5 mile east of mouth, eastern part of Marlinton).

Marlinton (county-seat) (2123') (14.5 miles north of Greenbrier County line, at mouth of Knapp Creek, 15.3 miles southwest of Cass).

Marys Chapel (2950') (on Old Field Fork of Elk River, 7.6 miles west of Stony Bottom).

Mash Run (of Knapp Creek, 6.2 miles northeast of Minnehaha Springs).

May (2960') (on West Fork of Greenbrier River, 7.7 miles north of Durbin).

May Chapel (2255') (in Greenbrier County, 0.2 mile north of Trainer, on Anthony Creek, 2 miles southwest of Pocahontas County line).

Meadow Creek Mountain (3600'+) (southeast corner of county, southwest of Hightop, in Greenbrier County).

Michael Mountain (3652', fire tower) (2.0 miles northwest of Frost, 5.0 miles southeast of Clover Lick).

Middle Fork (of Gauley River, 5.2 miles southwest of Slaty Fork).

Middle Fork (of Williams River, 1.4 miles east of Three Forks of Williams).

Middle Mountain (4415') (between Dry and Big Spring Forks of Elk River, 3.0 miles southwest of Mace).

Middle Mountain (4015') (north of Little River of West Fork of Greenbrier River, 8 miles northeast of Durbin, 2 miles east of May).

Middle Mountain (3750'-4500') (south of North Fork of Gauley River, 4.0 miles west of Slaty Fork).

Middle Mountain (3559') (southeastern part of county, northwest of Anthony Creek and east of North Fork of Anthony Creek and east of Douthat Creek, north end 1.4 miles west of Rimel).

Mikes Knob (4243') (0.4 mile southwest of Webster-Greenbrier County corner, in Greenbrier County, 7.4 miles northwest of Lobelia).

Mikes Run (of West Fork of Greenbrier River, 10.8 miles north of Durbin).

Mill Creek (of Old Field Fork of Elk River, 8.4 miles west of Stony Bottom).

Mill Point (2217') (1.3 miles up Stamping Creek, from Greenbrier River, 2 miles northeast of Hillsboro).

Mill Run (of Big Spring Fork of Elk River, 8.0 miles northwest of Cass).

Mill Run (of Greenbrier River, south of Kennison, 5.1 miles north of Greenbrier County line).

Mill Run (of Knapp Creek, 6.7 miles northeast of Minnehaha Springs).

Mill Run (of Leatherbark Run, 0.9 mile north of Cass).

Mill Run (of West Fork of Greenbrier River, at May, 7.7 miles north of Durbin).

Mill Run (of Williams River, 1.7 miles northeast of Three Forks of Williams).

Mill Run (town) (2029') 4.5 miles north of Greenbrier County line, on Greenbrier River, 10.8 miles southwest of Marlinton).

Miller Ridge (3200'+) (east of Browns Creek and west of Browns Mountain, 3.0 miles northeast of Minnehaha Springs).

Millstone Creek (2.0 miles northeast of Lobelia, sinks 1.8 miles northwest of Mill Run).

Millstone Run (of Riley Run of Deer Creek, 0.8 mile northeast of Arbovale).

Mingo (2639') (on Tygart River, 3.0 miles northwest of Mace, in Randolph County).

Mingo Knob (4150'+) (Randolph County, 3.5 miles northwest of Mace).

Mingo Run (of Tygart River, at Upper Mingo, Randolph County, 2.7 miles northwest of Mace).

Minnehaha Springs (2330') (on Knapp Creek, at mouth of Laurel Creek, 2.6 miles southeast of Huntersville).

Moffett Knob (4170') (7.7 miles north of Marlinton, 5.6 miles west of Clover Lick).

Monday Lick Run (of Greenbrier River, 2.2 miles south of Marlinton).

Monongahela National Forest (northeastern portion of county, east of West Fork of Greenbrier River and north of East Fork of Greenbrier River).

Moore Run (of Knapp Creek, 7.5 miles northeast of Minnehaha Springs).

Moore Run (of Sitlington Creek, 2.6 miles east of Sitlington).

Moore School (2430') (on Knapp Creek, 6.0 miles northeast of Minnehaha Springs).

Moses Spring Run (of Greenbrier River, opposite Raywood, 2.0 miles south of Cass).

Mt. Carmel Church (2368') (on Knapp Creek, 3.4 miles northeast of Minnehaha Springs).

Mt. Hope Church (2629') (on Shock Run of Sitlington Creek, 2.2 miles southeast of Dunmore).

Mt. Lebanon Church (2750'±) (0.9 mile south of Lobelia, on Rush Run).

Mt. Pleasant School (2537') (on Indian Draft of Stony Creek, 4.0 miles north of Marlinton).

Mt. Pleasant School (2650'±) (on Shock Run of Sitlington Creek, 2.4 miles southeast of Dunmore).

Mt. Tabor School (2900'±) (on Browns Mountain, 4.9 miles northeast of Minnehaha Springs, 4.5 miles northeast of Huntersville).

Mt. Vernon Church (2499') (on Knapp Creek, 8.4 miles northeast of Minnehaha Springs).

Mt. Zion Church (3105'±) (1.2 miles south of Spice, on Droop Mountain).

Mt. Zion School (3000'+) (5.5 miles east of Clawson, 5.2 miles southeast of Clover Lick).

Mountain Lick Creek (of West Fork of Greenbrier River, 1.4 miles north of Durbin).

Mountain Lick Run (of Williams River, 10.6 miles southeast of Webster County line, 5.7 miles west of Marlinton).

Mulberry Run (of Saulsbury Run of Deer Creek, 5.3 miles northeast of Arbovale).

Mullenax Run (of East Fork of Greenbrier River 5.3 miles northeast of Thornwood P. O.).

Narrow Branch (of Anthony Creek, mouth in Greenbrier County, 1 mile south of Pocahontas line, 1.1 miles northeast of Trainer).

Nazarene Church (3210') (on Laurel Creek of Williams River, 5.2 miles northwest of Marlinton).

New Pleasant Valley School (2955'±) (on Old Field Fork of Elk River, 7.1 miles west of Stony Bottom).

Newman Hollow (of Knapp Creek, 6.4 miles northeast of Minnehaha Springs).

Newroad Run (of Thorny Creek, 0.4 mile up, 0.9 mile east of August).

Nicholas Run (of Cochran Creek, 1.2 miles southwest of Rimel).

Nida (2565') (on Greenbrier River, 5.2 miles northeast of Cass).

Nigh Gap Run (of Oldham Run of Greenbrier River, 2.0 miles north of Greenbrier County line, 0.6 miles east of Locust).

North Fork (of Anthony Creek, 6.5 miles west of Virginia State line at Hightop).

North Fork (of Cherry River, 2.3 miles south of Webster-Greenbrier County corner, 5.6 miles northwest of Lobelia).

North Fork (of Cranberry River, 1.9 miles east of Webster County line, 9 miles north of Lobelia).

North Fork (of Deer Creek, 0.5 mile up, 0.6 mile southwest of Green Bank).

North Fork (of Gauley River, 4.2 miles west of Slaty Fork).

North Fork School (2550'±) (on North Fork of Anthony Creek, 2.0 miles northeast of Greenbrier County line).

North Fork School (2900'±) (on North Fork of Deer Creek, 2.8 miles east of Green Bank).

Nottingham P. O. (Boyer Station) (2662') (on Greenbrier River, 2.5 miles southwest of Durbin).

Oak Grove School (2677') (2.2 miles southwest of Spice, 0.7 mile northeast of Jacox, in southwestern part of county).

Oak Grove School (2800'±) (on Rosen Run of North Fork of Deer Creek, 4.4 miles northeast of Dunmore, 1.7 miles southeast of Green Bank).

Oak Hill School (3010') (on divide between Millstone and Trimble Runs, 3.0 miles northeast of Green Bank, 1.8 miles east of Arbovale).

Old Field Fork (of Elk River, at Slaty Fork, 11.7 miles west of Cass).

Old House Knob (3250'+) (west of Greenbrier River, 5.9 miles northeast of Cass, 0.6 mile west of Hosterman).

Old House Run (of Little River of East Fork of Greenbrier River, 2.5 miles south of Thornwood P. O.).

Oldham Run (of Greenbrier River, 1.6 miles north of Greenbrier County line, 0.5 mile east of Locust).

Olive (2785') (mouth of Mountain Lick Creek of West Fork of Greenbrier River, 1.4 miles north of Durbin).

Oliver School (2856') (head of a north branch of Leatherbark Run of Greenbrier River, 1.7 miles north of Cass).

Onoto (2450'±) (former location of post-office, 2351') (on Dry Creek of Stony Creek, 3.4 miles northwest of Marlinton).

Overholt Run (of Swago Creek, 1.8 miles northwest of Buckeye).

Paddy Knob (4494') (on Allegheny Mountain, on Virginia State line, 0.4 mile southwest of Highland-Bath County corner).

Panther Run (of North Fork of Gauley River, 4.0 miles west of Slaty Fork).

Perry Run (of Oldham Run, 2.7 miles northeast of Greenbrier County line on Greenbrier River, 0.6 mile southeast of Denmar).

Peters Mountain (3295') (between Sitlington and Deer Creeks, 1.8 miles southeast of Cass).

Pigeon Run (of Stony Creek, 4.8 miles northwest of Marlinton).

Pine Grove School (2740'±) (on branch of Duncan Run of Deer Creek, 1.3 miles northeast of Arbovale).

Pine Grove School (2500') (on Stony Creek, at Onoto).

Pine Grove School (2260'±) (in Greenbrier County, on Anthony Creek, 0.5 mile north of Trainer).

Pleasant Grove School (2288') (1 mile northeast of Hillsboro).

Pleasant Ridge School (2460'±) (on Brush Lick Run of Greenbrier River, 0.7 mile northwest of August).

Pleasant Valley (2950'-3000') (near head of Old Field Fork of Elk River, 7.0 miles west of Stony Bottom).

Poages Chapel (2767') (on divide between Laurel Run and Cloverlick Creek, 1.5 miles northwest of Big Run).

Poca Ridge (4000'+) (east of East Fork of Greenbrier River, 4.0 miles northeast of Thornwood P. O.).

Poca Run (of East Fork of Greenbrier River, 2.3 miles northeast of Thornwood P. O.).

Point Mountain (4102') (1 mile west of Falls of Hills Creek, south of North Fork of Cherry River).

Pond Ridge (3066') (between Laurel and Oldham Runs of Greenbrier River, east of Denmar).

Possum Hollow (of Knapp Creek, 1.5 miles southeast of Huntersville, and 1.2 miles northwest of Minnehaha Springs).

Price Run (of Greenbrier River, west of Marlinton).

Props Run (of Elk River, 3.6 miles south of Randolph County line, 0.5 mile north of Slaty Fork).

Pyle Mountain (3211') (west of Beaver Creek, 4.0 miles east of Kennison).

Rainbow Run (of Browns Creek, 4.6 miles north of Minnehaha Springs, and 3.5 miles northeast of Huntersville).

Raintown (2650') (near head of Stamping Creek, 3.3 miles northwest of Mill Point).

Rambottom Run (of East Fork of Greenbrier River, 0.7 mile northeast of Thornwood P. O.).

Ramshorn (4450') (spur of Allegheny Mountain, 8.0 miles northeast of Dunmore).

Raywood (2380') (on Greenbrier River, 2.0 miles south of Cass).

Red Lick Mountain (4690') (6.5 miles northwest of Marlinton, west of head of Old Field Fork of Elk River).

Red Run (of Cranberry River, 4.6 miles southeast of Webster County line, 10.6 miles west of Marlinton).

Red Run (of Right Fork of Tea Creek, 10.5 miles northwest of Marlinton, 4.8 miles southwest of Slaty Fork).

Renicks Valley (2455') (1 mile south of county line in Greenbrier County, 3.8 miles west of Spice Run—Locust P. O.).

Reservoir Hollow (of East Fork of Greenbrier River, at Thornwood P. O.).

Rich Patch Hollow (of Thomas Creek, 3.3 miles southeast of Clover Lick).

Rider Gap (2500'+) (on Allegheny Mountain, 0.5 mile east of Rimel, on Virginia State line).

Rider Run (of Cochran Creek, 0.7 mile from mouth, 0.8 mile southwest of Rimel).

Right Fork (of Leatherwood Creek of Elk River, 2.7 miles northwest of Slaty Fork).

Right Fork (of Tea Creek of Williams River, 5.4 miles southwest of Slaty Fork).

Riley Run (of Deer Creek, 1.0 mile northwest of Arbovale).

Rimel (2438′) (at mouth of Cochran Creek, on Laurel Creek, near Virginia State line, 10½ miles southeast of Marlinton).

Rimel School (2450′±) (0.9 mile southwest of mouth of Cochran Creek, 1 mile southwest of Rimel).

Riverside School (2180′) (0.4 mile northwest of Watoga, on west side of Greenbrier River).

Robbins Run (at southwestern corner of county, 4.0 miles southwest of Lobelia).

Rock Run (of Greenbrier River, 1 mile east of Kennison, 5½ miles north of Greenbrier County line).

Rocklick Run (of Williams River, in Webster County, 0.6 mile west of Pocahontas County line, 9 miles southwest of Slaty Fork).

Rocky Knob (4446′) (on Yew Mountains, 3.6 miles northwest of Lobelia).

Rocky Run (of Shavers Fork of Cheat River, 2.0 miles north of Spruce).

Rodgers Mountain (3895′) (2.0 miles west of Buckeye).

Rosen Run (of North Fork of Deer Creek, 4.4 miles northeast of Dunmore, 0.5 mile southwest of Green Bank).

Rough Knob (3925′) (1.4 miles southeast of Thornwood P. O.).

Round Knob (3980′) (west of Hinkle Run of Little River of West Fork of Greenbrier River, 8.0 miles northeast of Durbin).

Round Mountain (3200′+) (1.5 miles northwest of Lobelia).

Ruckman Run (of Knapp Creek, 2.7 miles northeast of Minnehaha Springs).

Ruckman School (2289′) (on Stevens Hole Run of Greenbrier River, 1.4 miles northwest of Violet).

Rush Run (south of Lobelia, sinks 0.9 mile northeast of Oak Grove School).

Sandy Ridge (3565′) (east of Greenbrier River, 1.3 miles southeast of Durbin).

Saulsbury Run (of Deer Creek, 2.9 miles north of Arbovale).

Saulsbury Run School (2875′±) (4.7 miles northeast of Arbovale).

Second Fork (of Shavers Fork of Cheat River, 5.0 miles west of Nottingham P. O.).

Second Run (of Thorny Creek, 0.8 mile up, 1.3 miles east of August).

See All (3222′) (high knob 6.6 miles northeast of Minnehaha Springs, and 6.3 miles northeast of Huntersville).

Seebert (2050′) (on Greenbrier River, 6.8 miles northeast of Greenbrier County line, 8.0 miles southwest of Marlinton).

Sevenmile Run (of Anthony Creek, 1.3 miles northeast of Greenbrier County line.

Sharp Hollow (of Moore Run of Knapp Creek, 8.2 miles northeast of Minnehaha Springs).

Sharp Knob (4535′) (on Gauley Mountain, 2.0 miles west of Slaty Fork, near head of Props Run).

Sharp Run (of Stony Creek, 0.7 mile up, 1.3 miles north of Marlinton).

Shavers Fork (of Cheat River, 6.5 miles southwest of Durbin).

Shavers Mountain (4445′) (west side of Greenbrier River, at Randolph County line, northwestern corner of county, south to junction with Back Allegheny Mountain).

Shingleblock Run (of Saulsbury Run of Deer Creek, 4.9 miles northeast of Arbovale).

Shock Run (of Sitlington Creek, 1.7 miles southeast of Dunmore).

Shumate Hollow (of Knapp Creek, 6.9 miles northeast of Minnehaha Springs).

Sideling Run (of Brush Lick Run of Greenbrier River, 2.3 miles northeast of Marlinton).

Simmons Run (of East Fork of Greenbrier River, 7.0 miles northeast of Thornwood P. O.).

Sitlington (2363') (on Greenbrier River, at mouth of Sitlington Creek, 2.7 miles south of Cass).

Sitlington Creek (of Greenbrier River, 2.6 miles south of Cass).

Slabcamp Branch (of Williams River, 1.1 miles west of Webster County line, 9.4 miles southwest of Slaty Fork).

Slabcamp Ridge (4050'+) (between Big Run and North Fork of Gauley River, 4.5 miles west of Slaty Fork).

Slabcamp Run (of Little River of East Fork of Greenbrier River 3.2 miles south of Thornwood P. O.).

Slate Lick Knob (3350'+) (north of Knapp Creek, 1.6 miles northeast of Frost, 10.8 miles northeast of Minnehaha Springs).

Slaty Fork (of Old Field Fork of Elk River, 11.3 miles west of Cass).

Slaty Fork (town) (2671') (on Elk River, at junction of Big Spring and Old Field Forks, 4.0 miles south of Randolph County line, 13.5 miles north of Marlinton).

Slaty Ridge (3750'-4415') (north of Slaty Fork of Elk River, 8.0 miles west of Cass).

Slavin Hollow (of Deer Creek, 1.4 miles west of Arbovale).

Smoke Camp Knob (4218') (on Fork Mountain, 1.8 miles east of Thornwood P. O.).

Snorting Lick Run (of West Fork of Greenbrier River, at Wildell, 12.0 miles north of Durbin).

Snyder Knob (4612') (Randolph County, 1.4 miles west of Hopkins).

South Fork (of Cherry River, 5.4 miles south of Webster-Greenbrier County corner, 4.0 miles northwest of Lobelia).

South Fork (of Gauley River, at Three Forks of Gauley, 6.0 miles west of Slaty Fork).

South Fork Mountain (4050'+) (on Randolph-Pocahontas County line, 1.4 miles northeast of Webster-Randolph corner, 5.5 miles southwest of Slaty Fork).

Span Oak Run (of Little River of West Fork of Greenbrier River, 6.3 miles northeast of Durbin).

Spencer School (3900'±) (on Frank Mountain, 1.9 miles north of Top of Allegheny, 3.8 miles southeast of Bartow).

Spice (3050'±) (on Droop Mountain, 2.6 miles west of Mill Run).

Spice Run (of Knapp Creek, 1.7 miles southeast of Marlinton).

Spice Run (of Greenbrier River, southern boundary of county for 4 miles, east of Greenbrier River).

Spice Run (Locust P. O.), (1987') 0.5 mile north of Greenbrier County line, on Greenbrier River, 14.5 miles southwest of Marlinton).

Spruce (3853') (on Shavers Fork of Cheat River, 5.0 miles northwest of Cass).

Spruce Flats (3475'±) (3.0 miles west of Marlinton).

Spruce Flats School (3475±') (on Spruce Flats, 3.0 miles west of Marlinton).

Spruce Knob (4710') (7.7 miles northwest of Marlinton, 6.6 miles south of Slaty Fork).

Spruce Lick Hollow (of Knapp Creek, 2.4 miles northeast of Minnehaha Springs).

Spruce Mountain (4335') (north of Hills Creek, 3.0 miles northwest of Lobelia).

Spruce Ridge (3820') (south of Buffalo Fork of Little River of East Fork of Greenbrier River, 2.3 miles southeast of Thornwood P. O.).

Spruce Run (of Hills Creek, 3.1 miles northwest of Lobelia).

Stamping Creek (of Greenbrier River, 0.7 mile north of Seebert).

Stark School (3750'±) (on East Fork of Greenbrier River, 1 mile south of Blister Swamp, 12.1 miles northeast of Durbin).

State Forest Game and Fish Reserve (south of Sitlington, on Thomas, Michael, and Thorny Creek Mountains).

Staunton and Parkersburg Pike (from Huttonsville, Randolph County, southeast to Cheat Bridge, Durbin, and Top of Allegheny).

Stevens Hole Run (of Greenbrier River, 1 mile southwest of Watoga).

Stillhouse Run (of Greenbrier River, 0.6 mile south of mouth of Knapp Creek, 1 mile south of Marlinton).

Stillwell (2126') (on Greenbrier River and Stillhouse Run, 1.0 mile south of Marlinton).

Stony Bottom (2329') (on Greenbrier River, 3.5 miles southwest of Cass).

Stony Creek (of Greenbrier River, 1 mile north of Marlinton).

Stony Creek Mountain (3500'+) (1.3 miles west of Marlinton, west of Stony Creek).

Stony Run (of Sitlington Creek, 3.7 miles east of Dunmore).

Straight Creek (of Gauley River, 1 mile northwest of Webster-Randolph-Pocahontas County corner, 8.7 miles west of Slaty Fork).

Straight Creek Mountain (3800'+) (south of Gauley River, at Three Forks of Gauley).

Sugar Creek (of Williams River, 3.7 miles southeast of Webster County line, 8.0 miles southwest of Slaty Fork).

Sugar Creek Mountain (4550'+) (south of Williams River, between Kins and Sugar Creeks, 3.0 miles southeast of Webster County line, 9 miles southwest of Slaty Fork).

Sugar Hall Run (of Anthony Creek, 1.6 miles northeast of Greenbrier County line, 4.0 miles southwest of Rimel).

Sugar Run (of Galfred Run of Sitlington Creek, 4.8 miles northeast of Dunmore).

Sugarcamp Run (of Knapp Creek, 0.8 mile west of Frost).

Sugartree Bench Mountain (4276') (on western Greenbrier-Pocahontas County line, 4.0 miles west of Lobelia).

Summit School (4354') (on Allegheny Mountain, at Virginia State line, 8.0 miles northeast of Green Bank).

Sunday Lick Run (of Greenbrier River, 2.0 miles south of Marlinton).

Sunrise School (3107') (0.5 mile southwest of Spice, on Droop Mountain).

Sunset School (2365'±) (on Knapp Creek, 3.1 miles northeast of Minnehaha Springs).

Sutton Run (of North Fork of Deer Creek, 3.8 miles east of Green Bank).

Swago Creek (of Greenbrier River, at Buckeye, 3.5 miles southwest of Marlinton).

Swago Mountain (4430') (3.3 miles northwest of Buckeye).

Sweet Lick Run (of Laurel Run of Greenbrier River, 2.7 miles east of Clover Lick).

Tacker Fork (of North Fork of Deer Creek, 4.6 miles east of Green Bank).

Tallman Ridge (3167') (west side of Greenbrier River, 1 mile north of Cass).

Tallow Knob (4035') (7.0 miles west of Cass).

Tamarack Ridge (4400'+) (on Allegheny Mountain, at Virginia State line, 7.0 miles northeast of Arbovale, 1.8 miles east of Top of Allegheny).

Tea Creek (of Williams River, 3.2 miles southeast of Webster County line, 8.0 miles southwest of Slaty Fork).

Tea Creek Mountain (4650'+) (2.0 miles northwest of Spruce Knob, 5.7 miles southwest of Slaty Fork).

The Burning (south of Burning Run of East Fork of Greenbrier River, 5.5 miles northeast of Thornwood P. O.).

The Dock (2718') (on head of North Fork of Anthony Creek, 5.0 miles southwest of Minnehaha Springs).

The Horse Ridge (3245') (north end of Browns Mountain, 5.0 miles northeast of Minnehaha Springs).

The Pigs Ear (3850'+) (on East Fork of Greenbrier River, 8.0 miles northeast of Thornwood P. O.).

Thomas Creek (of Sitlington Creek, 1 mile east of Sitlington).

Thomas Mountain (3362') (west of Thomas Creek, 2.0 miles northeast of Clover Lick).

Thornwood P. O. (Winterburn Station) (2871') (on East Fork of Greenbrier River, at mouth of Little River, 5.0 miles east of Durbin).

Thorny Branch (of Sitlington Creek, 1.9 miles southeast of Dunmore).

Thorny Creek (of Greenbrier River, 3.6 miles northeast of Marlinton).

Thorny Creek (town) (2175') (on Greenbrier River, 3.7 miles northeast of Marlinton).

Thorny Creek Mountain (3458') (between Thorny Creek and Greenbrier River 7 to 11 miles northeast of Marlinton).

Thorny Creek School (2647') (on Thorny Creek, 3.0 miles east of Big Run, and 2.0 miles northeast of Dilleys Mill).

Thorny Flat (4839') (junction of Cheat and Back Allegheny Mountains, 4.0 miles west of Cass).

Three Forks of Gauley (2858') (0.1 mile west of Webster-Randolph County line, 1.6 miles north of Webster-Randolph-Pocahontas County corner, 6.0 miles west of Slaty Fork).

Three Forks of Williams (2354') (in Webster County, 1.4 miles west of Pocahontas County line, 14.5 miles southwest of Slaty Fork).

Tilda Fork (of Stamping Creek, 2.7 miles from mouth, and 1.5 miles northwest of Mill Point).

Toolbox Hollow (of Big Run of Buffalo Fork of Little River of East Fork of Greenbrier River, 3.4 miles southeast of Thornwood P. O.).

Top of Allegheny (4199') (on Buffalo Ridge of Allegheny Mountain, 5.5 miles northeast of Arbovale).

Trainer (2240'±) (in Greenbrier County, on Anthony Creek, 2.0 miles southwest of Pocahontas County line, 7.4 miles southwest of Rimel).

Trainer School (2345') (on Anthony Creek, 0.4 mile north of Greenbrier County line, 5.0 miles southwest of Rimel).

Trimble Run (of Duncan Run of Deer Creek, 1.6 miles northeast of Arbovale).

Trinity Church (2300'±) (on Stamping Creek 1.3 miles northwest of Mill Point).

Trout Run (of Greenbrier River, 4.9 miles northeast of Cass).

Trump Run (of Locust Creek of Greenbrier River, mouth at Locust).

Tumbling Rock Run (of Cranberry River, 1.2 miles northeast of Webster County line, 14 miles northwest of Marlinton).

Turkey Mountain (4300'+) (at Webster-Randolph-Pocahontas County line, 6.7 miles southwest of Slaty Fork).

Twin Branches (2509') (on Williams River, 3.1 miles northeast of Three Forks of Williams, in Webster County).

Two Lick Run (of Cochran Creek, 1.8 miles southwest of Rimel).

Tygart River (7.3 miles northwest of Cass, near Mace).

Upper Mingo (2691') (in Randolph County, on Tygart River, 2.8 miles northwest of Mace).

Upper Mountain (3100'+) (east of Moore Run of Sitlington Creek, 1.8 miles northeast of Dunmore).

Valley Draft (of Knapp Creek, 6.7 miles northeast of Minnehaha Springs).

Valley Mountain (3845') (north of head of Dry Fork of Elk River, 2.0 miles west of Mace).

Viney Mountain (3736') (between Millstone and Bruffey Creeks, 2.5 miles northeast of Lobelia).

Violet (2084') (on Greenbrier River, 0.9 mile northeast of Watoga).

Walderman Run (of Poca Run of East Fork of Greenbrier River, 3.5 miles northeast of Thornwood P. O.).

Wanless (2988') (on Wanless Run of Greenbrier River, 3.0 miles north of Cass).

Wanless Run (of Greenbrier River, 3.5 miles northeast of Cass).

Wanless Station (2511'—) (on Greenbrier River, at mouth of Wanless Run, 3.5 miles northeast of Cass).

Ward Knob (4507') (in Randolph County, 6.5 miles west of Nottingham P. O.).

Warwick (2603') (on Indian Draft of Stony Creek, 4.3 miles northeast of Marlinton).

Watering Pond Knob (4587') (on Allegheny Mountain, 7.2 miles northeast of Green Bank).

Watoga (2080') (on Greenbrier River, 2.0 miles northeast of Seebert).

Watoga State Park (south of Watoga, on east side of Greenbrier River, on Chicken House and Island Lick Runs, east of Pyle Mountain).

Wesley Chapel (2763') (on Sitlington Creek, 3.6 miles northeast of Dunmore).

West Droop School (3061') (2.8 miles south of Spice and 3.3 miles west of Beard, on Droop Mountain).

West Fork (of Greenbrier River), (at Durbin, north to Randolph County line).

West Union Church (2650'±) (on Stony Creek, 3.8 miles up, 4.0 miles northwest of Marlinton).

West Union School (2675'±) (on branch of Stony Creek, 3.6 miles northwest of Marlinton).

Westminster Church (2375'±) (on Knapp Creek, 3.7 miles northeast of Minnehaha Springs).

White Church (3216') (on Laurel Creek of Williams River, 5.7 miles northwest of Marlinton).

White Rocks (3662') (on Beaver Lick Mountain, 7.0 miles east of Seebert).

Widemouth Run (of Cochran Creek, 2.1 miles southwest of Rimel).

Wildcat Hollow (of Knapp Creek, 5.8 miles northeast of Minnehaha Springs).

Wildcat Run (of Anthony Creek, 0.5 mile north of Greenbrier County line).

Wildell (3056') (on West Fork of Greenbrier River, 12.0 miles north of Durbin).

Williams River (crosses county line 1.6 miles southwest of Webster-Randolph-Pocahontas County corner, southwestern part of county, at County Line Branch, 8.4 miles southwest of Slaty Fork).

Winterburn Station (Thornwood P. O.) (2871') (on East Fork of

Greenbrier River, at mouth of Little River, 5.0 miles east of Durbin).

Wolfpen Ridge (3050′+) (0.8 mile west of Edray, 3.7 miles north of Marlinton).

Woodrow (3202′) (on divide between Stony and Laurel Creeks, 5.2 miles northwest of Marlinton).

Woodrow School (3210′±) (on Laurel Creek of Williams River, 5.3 miles northwest of Marlinton).

Woods Run (of Greenbrier River, at Stony Bottom).

Yew Mountains (4600′+) (western Edray District, 10 to 12 miles northwest of Marlinton).

Yewglade School (3125′) (on Big Spring Fork of Elk River, 6.3 miles west of Cass).

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